

LENGTH, MASS AND CAPACITY

SUB TOPIC: Comparing units/conversion of metric units(review)

Examples:

Comparing metric units

Km	Hm	Dm	Metre	dm	cm	mm
Kg	Hg	Dg	Gram	dg	Cg	mg
lI	lI	lI	Litre	dl	Cl	MI

- (a) Change 7m to millimetres

$$1m = 1000mm$$

$$\begin{aligned} 7m &= (7 \times 1000m) \\ &= \underline{\underline{7000mm}} \end{aligned}$$

- (b). Change 800m to km

$$1000m = 1km$$

$$800m = \frac{800}{1000}$$

$$\begin{aligned} &= \frac{8}{10} \\ &\equiv \underline{\underline{0.8km}} \end{aligned}$$

Convert the following as instructed

- (a) 4km to metres
- (b) 0.4 litres to milliliters
- (c) 2000g to kg
- (d) 50cm to m

Mathematics is the key

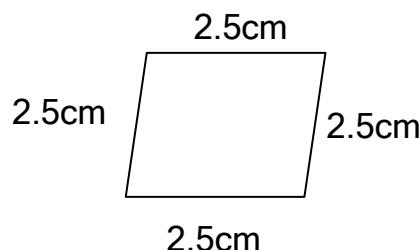
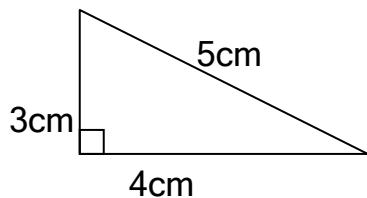
SUB TOPIC: Finding perimeter

Perimeter is the total distance around the figure

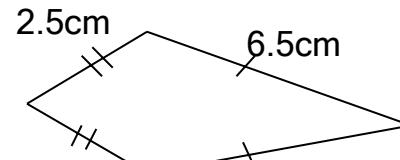
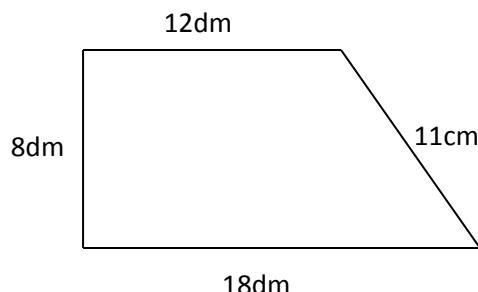
Examples:

Find the distance (Perimeter) around the shapes given below:

(i)



$$\begin{aligned}P &= 4\text{cm} + 3\text{cm} + 5\text{cm} \\&= 7\text{cm} + 5\text{cm} \\&= 12\text{cm}\end{aligned}$$



Mathematics

SUB TOPIC: FINDING AREA OF SIMPLE SHAPES

BASIC FORMULAE

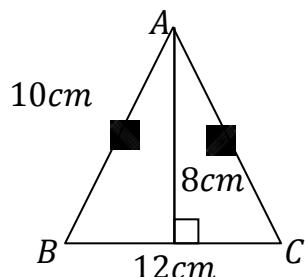
$$SQUARE = S \times S$$

$$RECTANGLE = L \times W$$

$$TRIANGLE = \frac{1}{2} b h$$

$$TRAPEZIUM = \frac{1}{2} h(a + b)$$

1. Find the area of the shapes below

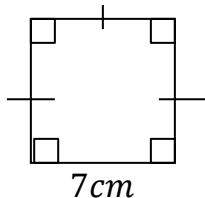


$$\begin{aligned}A &= \frac{1}{2} \times b \times h \\&= \frac{1}{2} \times 12\text{cm} \times 8\text{cm} \\&= 6\text{cm} \times 8\text{cm} \\A &= 48\text{cm}^2\end{aligned}$$



$$\begin{aligned}A &= L \times W \\&= 9\text{cm} \times 5\text{cm} \\&= 45\text{cm}^2\end{aligned}$$

Is the
Key

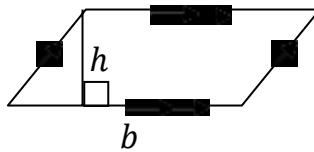


$$\begin{aligned}
 A &= S \times S \\
 &= 7\text{cm} \times 7\text{cm} \\
 &= \underline{\underline{49\text{cm}^2}}
 \end{aligned}$$

Try these

- Find the area of a square whose side is 13m
- Calculate the area of a rectangle whose length is 14dm and width is 9dm.
- Find the area of a triangle whose base is 25cm and height is 30cm.

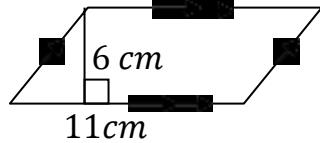
SUB TOPIC: Finding area of a parallelogram



$$\text{PARALLELOGRAM} = b \times h$$

Examples

- Workout the area of the figure below.

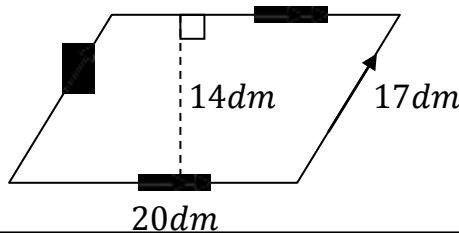


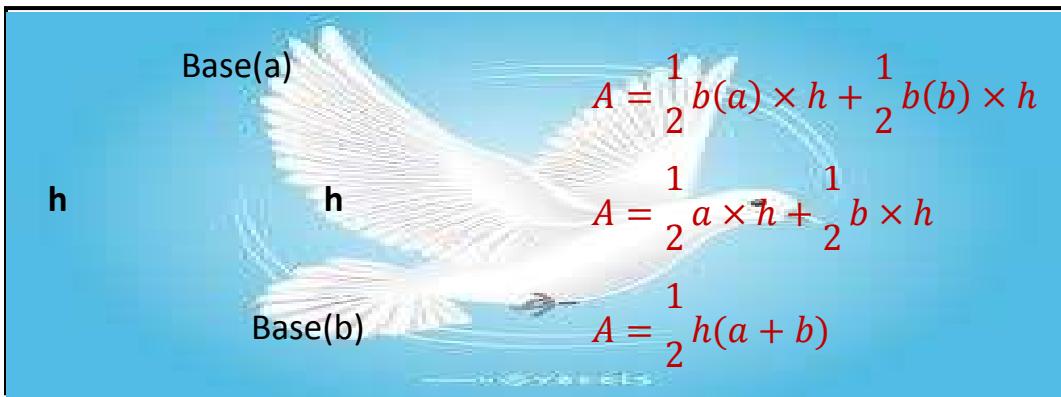
$$\begin{aligned}
 A &= b \times h \\
 &= 11\text{cm} \times 6\text{ cm} \\
 &= \underline{\underline{66\text{cm}^2}}
 \end{aligned}$$

- Find the area of a parallelogram whose base is 17cm and height is 10cm.

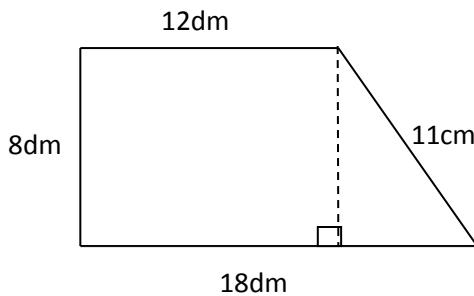
$$\begin{aligned}
 A &= b \times h \\
 A &= 17\text{cm} \times 10\text{cm} \\
 A &= \underline{\underline{170\text{cm}^2}}
 \end{aligned}$$

- Find the area of a parallelogram whose base and height are 16cm and 11cm respectively.
- Find the area and perimeter of the figure below



Examples

- Find the area of the figure below.



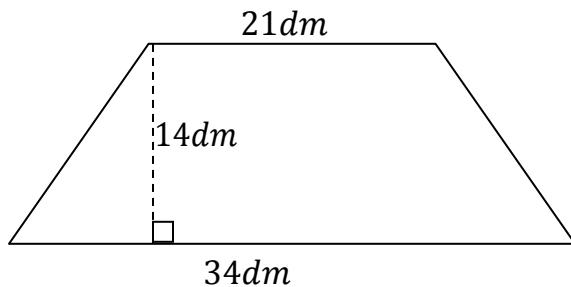
$$A = \frac{1}{2} h(a + b)$$

$$A = \frac{1}{2} \times 8dm(18dm + 12dm)$$

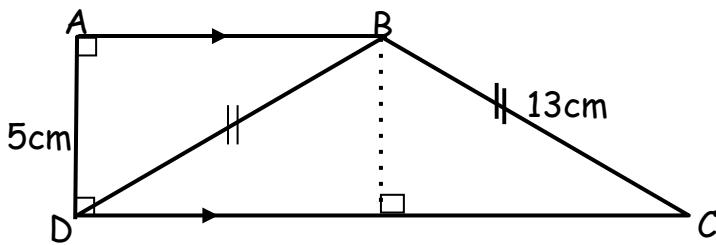
$$A = 4dm \times 30dm$$

$$\underline{\underline{A = 120dm^2}}$$

- Find the area of the figure below.



- The figure below is made up of two triangles ABD and BCD. Line BC=BD = 13cm, line AD = 5cm, line DC=24cm, AB= 12cm.



Calculate the area of the figure ABCD

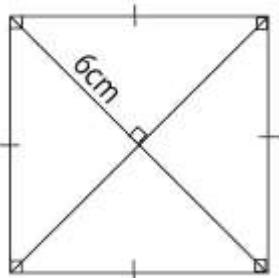
Mathematics
is the
key

SUB TOPIC: Finding area of a square, kite and rhombus using diagonals

NOTE: All shapes whose diagonals meet at a right angle use a similar formulae for area.

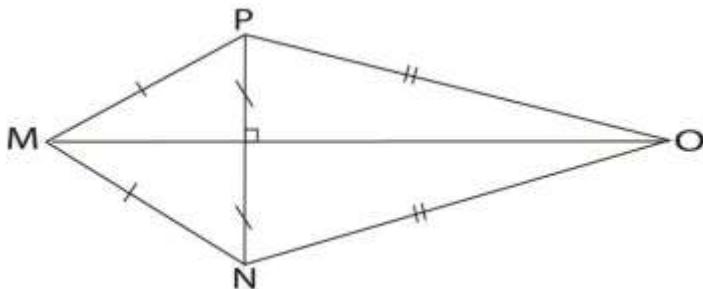
$$\text{AREA} = \frac{1}{2} \times d_1 \times d_2$$

- Calculate the area of the square below



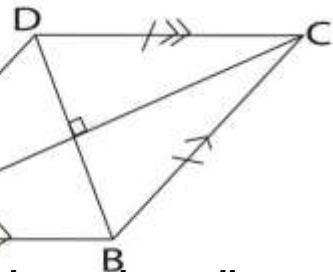
$$\begin{aligned}\text{AREA} &= \frac{1}{2} \times d_1 \times d_2 \\ d_1 &= 6\text{cm} + 6\text{cm} \\ &\equiv 12\text{ cm} \\ \text{Area} &= \frac{1}{2} \times 12\text{cm} \times 12\text{cm} \\ &= 6\text{cm} \times 12\text{cm} \\ &\equiv 72\text{ cm}^2\end{aligned}$$

- In the figure below, line MO = 12cm and line PN = 5cm. Calculate its area.



$$\begin{aligned}\text{AREA} &= \frac{1}{2} \times d_1 \times d_2 \\ d_1 &= 12\text{ cm} \quad d_2 = 5\text{cm} \\ \text{Area} &= \frac{1}{2} \times 12\text{cm} \times 5\text{cm} \\ &= 6\text{cm} \times 5\text{cm} \\ &\equiv 30\text{ cm}^2\end{aligned}$$

- Diagonals of rhombus ABCD measure 16m by 12m. Calculate its area.



$$\begin{aligned}\text{AREA} &= \frac{1}{2} \times d_1 \times d_2 \\ d_1 &= 16\text{m} \quad d_2 = 12\text{m} \\ \text{Area} &= \frac{1}{2} \times 16\text{m} \times 12\text{m} \\ &= 96\text{ m} \times 12\text{m}\end{aligned}$$

REMEMBER:

Since these shapes have diagonals which meet at a right angle.

Divide the shape into right angled triangles and look for area of each triangle.

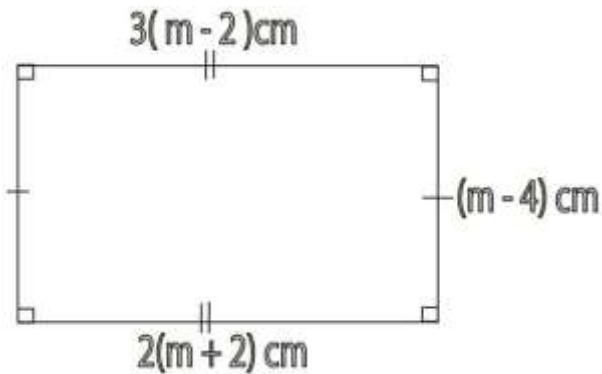
Later combine the areas.

Try these

- Find the area of a kite whose diagonals are 12cm and 4cm.
- Find the area of a square whose diagonal is 10cm.
- Calculate the area of a rhombus whose diagonals are 16cm and 10cm.

SUB TOPIC: Comparing sides of a polygon

1. Study the figure below



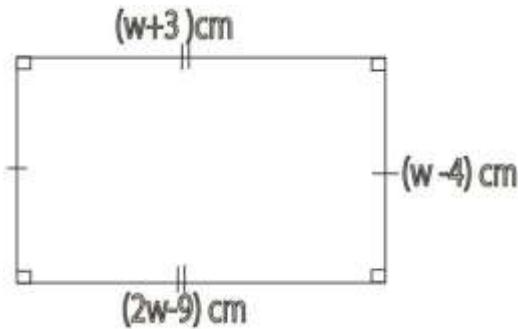
(a) Find the value of m

$$2(m + 2)cm = 3(m - 2)cm$$
$$2(m + 2) = 3(m - 2)$$
$$2m + 4 = 3m - 6$$
$$2m - 3m = -6 - 4$$
$$-m = -10$$
$$\frac{-m}{-1} = \frac{-10}{-1}$$
$$\underline{m = 10}$$

(a) Find its area

$$\begin{aligned} \text{Length} &= 2(m + 2)cm & \text{width} &= (m + 4)cm \\ &= 2(10 + 2)cm & &= 10cm + 4cm \\ &= 2 \times 12cm & &= \underline{\underline{14cm}} \\ &= \underline{\underline{24cm}} \\ \text{Area} &= L \times W \\ &= 24cm \times 14cm \\ &= \underline{\underline{336cm^2}} \end{aligned}$$

Use the figure below to answer the questions



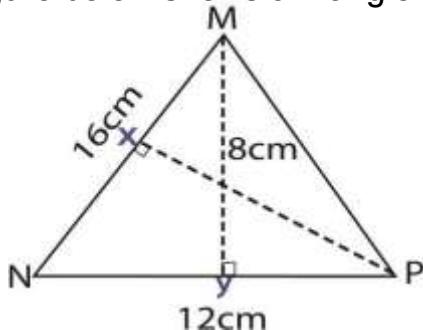
- (a) Find the value of w
(b) Find the area and perimeter of the figure

Mathematics
is the
key

SUB TOPIC: Comparing areas

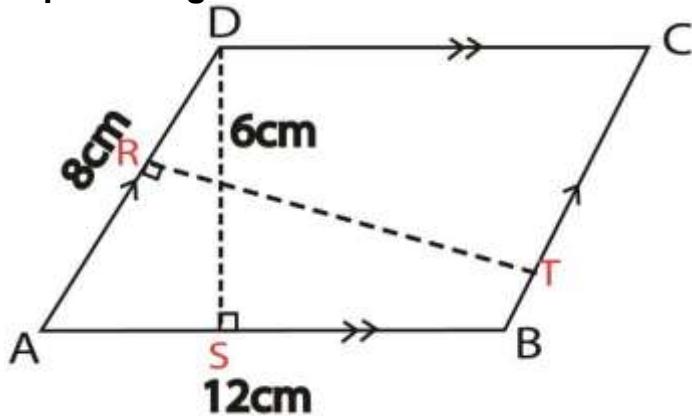
Example 1

1. The figure below shows a triangle with two heights. Find the length XP



$$\begin{aligned}\frac{1}{2}bh &= \frac{1}{2}bh \\ \frac{1}{2} \times 16\text{cm} \times h &= \frac{1}{2} \times 12\text{cm} \times 8\text{cm} \\ 8\text{cm}h &= 12\text{cm} \times 4\text{cm} \\ \frac{8\text{cm}h}{8\text{cm}} &= \frac{12\text{cm} \times 4\text{cm}}{8\text{cm}} \\ h &= 6\text{cm} \\ \underline{XP = 6\text{cm}}\end{aligned}$$

2. Study the parallelogram below and use it to answer the questions that follow

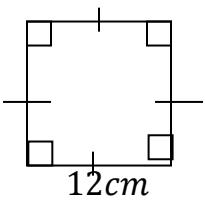


Find the length of line RT

$$\begin{aligned}bh &= bh \\ 8\text{cm} \times h &= 12\text{cm} \times 6\text{cm} \\ \frac{8\text{cm}h}{8\text{cm}} &= \frac{12\text{cm} \times 6\text{cm}}{8\text{cm}} \\ \underline{h = 9\text{cm}}\end{aligned}$$

Mathematics
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3. The area of the rectangle is equal to the area of the square below.



Find the value of w

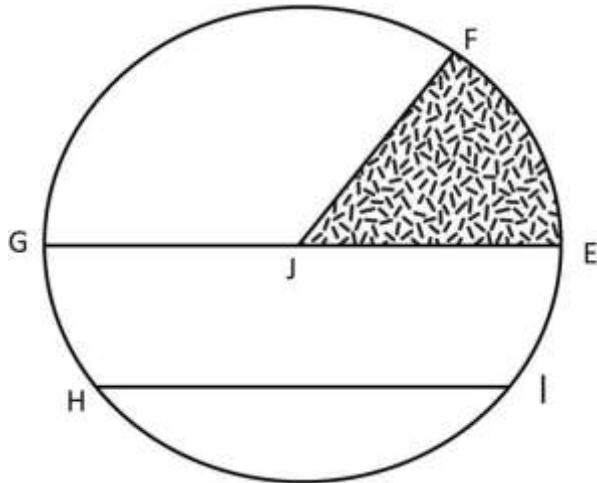
$$L \times W = S \times S$$

$$24\text{cm} \times W = 12\text{cm} \times 12\text{cm}$$

$$\frac{24\text{cm}W}{24\text{cm}} = \frac{12\text{cm} \times 12\text{cm}}{24\text{cm}}$$

$$\underline{\underline{W = 6\text{cm}}}$$

CIRCLE PROPERTIES (review)



GE = diameter

JE = radius

HI = chord

FE = arc

JEF = sector

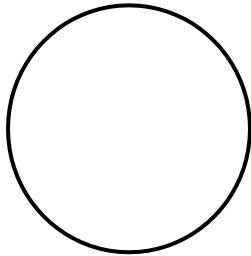
FEIHF = circumference

JF = ???

NOTE: The diameter is the longest chord

SUBTOPIC: Finding circumference of a circle and parts of a circle.

Circumference is the length of the arc.



CIRCLE

$$C = \pi D$$

SEMI CIRCLE

$$C = \frac{1}{2}\pi D$$

QUADRANT

$$C = \frac{1}{4}\pi D$$

SECTOR

$$C = \frac{\theta}{360^\circ} \pi D$$

θ = sector angle

Mathematics is the key to success

Mathematics

is the Key

1. Calculate the circumference of ; ($\pi = \frac{22}{7}$) (b) A semi circle whose radius is 7cm
 (a) A circle whose diameter is 7m.

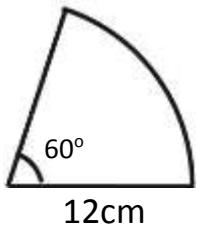
$$\begin{aligned} C &= \pi D \\ &= \frac{22}{7} \times 7m \\ &= \underline{\underline{22m}} \end{aligned}$$

$$\begin{aligned} C &= \frac{1}{2}\pi D \\ &= \frac{1}{2} \times \frac{22}{7} \times 7cm \times 2 \\ &= 11cm \times 2 \\ &= \underline{\underline{22m}} \end{aligned}$$

- (c) A quadrant whose radius is 14cm

$$\begin{aligned} C &= \frac{1}{4}\pi D \\ &= \frac{1}{4} \times \frac{22}{7} \times 14cm \times 2 \\ &= \frac{22}{4} \times 2cm \times 2 \\ &= \underline{\underline{22cm}} \end{aligned}$$

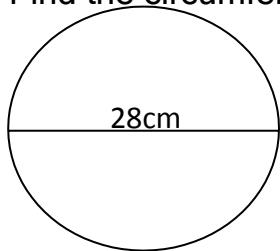
2. Calculate the circumference of the figure below.(Given that $\pi = 3.14$)



$$\begin{aligned} C &= \frac{\theta}{360^\circ} \pi D \\ &= \frac{60^\circ}{360^\circ} \times 3.14 \times 12cm \times 2 \\ &= \frac{1}{6} \times \frac{314}{100} \times 24cm \\ &= \frac{1256}{100} cm \\ &= \underline{\underline{12.56cm}} \end{aligned}$$

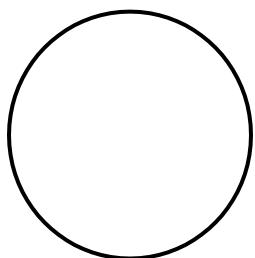
Activity

- Find the circumference of a circle whose diameter is 14cm. ($\pi = \frac{22}{7}$)
- Find the circumference of a semicircle whose diameter is 21cm. ($\pi = \frac{22}{7}$)
- Calculate the circumference of a quadrant whose radius is 28m. ($\pi = \frac{22}{7}$)
- Find the circumference of a circle below.



SUB TOPIC: Finding perimeter of a circle and parts of a circle

PERIMETER is the total distance around the city.



CIRCLE

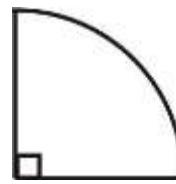
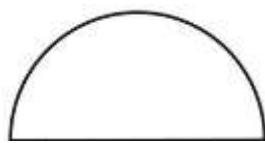
Perim. = Circ

$$P = \pi D$$

SEMI CIRCLE

$$P = C + D$$

$$P = \frac{1}{2}\pi D + D$$



QUADRANT

$$P = C + r + r$$

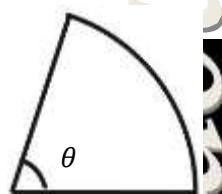
$$P = \frac{1}{4}\pi D + D$$

SECTOR

$$P = C + r + r$$

$$P = \frac{\theta}{360^\circ} \pi D + D$$

θ = sector angle



Examples

1. Calculate the perimeter of ;

(a) A semi-circle whose radius is 14cm($\pi = \frac{22}{7}$)

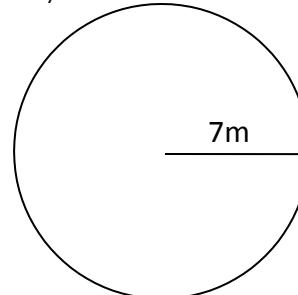
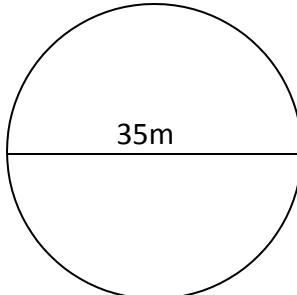
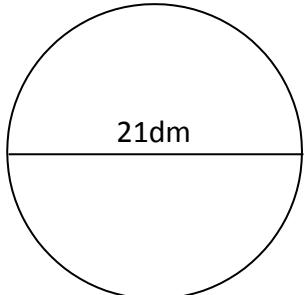
$$\begin{aligned} P &= \frac{1}{2}\pi D + D \\ &= \frac{1}{2} \times \frac{22}{7} \times 14\text{cm} \times 2 + 14\text{cm} \times 2 \\ &= 44\text{cm} + 28\text{cm} \\ &\equiv 72\text{cm} \end{aligned}$$

(b) A quadrant whose radius is 28cm. ($\pi = \frac{22}{7}$)

$$\begin{aligned} P &= \frac{1}{4}\pi D + D \\ D &= 28\text{cm} \times 2 = 56\text{cm} \\ P &= \frac{1}{4} \times \frac{22}{7} \times 56\text{cm} + 56\text{cm} \\ &= (22 \times 2) + 20\text{cm} \\ &= 44 + 20\text{cm} \\ &\equiv 64\text{cm} \end{aligned}$$

Activity

1. Find the perimeter of the circles below. (take $\pi = \frac{22}{7}$)



Mathematics
is the
key

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2. Find the perimeter of a semicircle whose diameter is;
 - (a) 14cm
 - (b) 28dm
3. Find the perimeter of a quadrant whose radius is 14cm

SUB TOPIC: Finding the radius or diameter when given circumference

Examples

1. The circumference of a circle is 88m.

Find its radius.

$$\pi D = P$$

$$\frac{22}{7} D = 88m$$

$$\frac{22D}{7} = 88m$$

$$7 \times \frac{22D}{7} = 88m \times 7$$

$$22D = 88 \times 7m$$

$$\frac{22D}{22} = \frac{88 \times 7m}{22}$$

$$D = 4 \times 7m$$

$$D = 28m$$

$$r = \frac{28m}{2}$$

$$r = 14m$$

2. The circumference of a circle is 66dm. Find its diameter.

$$\pi D = C$$

$$\frac{22}{7} \times D = 66dm$$

$$\frac{22D}{7} = 66dm$$

$$7 \times \frac{22D}{7} = 66dm \times 7$$

$$22D = 66dm \times 7$$

$$\frac{22D}{22} = \frac{66dm \times 7}{22}$$

$$D = 3dm \times 7$$

$$D = 21dm$$

Activity

1. Find the radius of a circle whose circumference is;

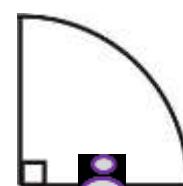
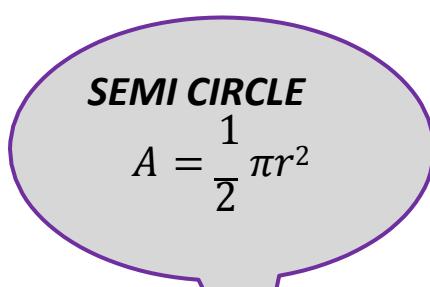
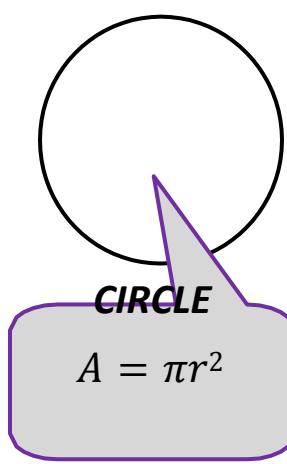
- (a) 44cm

- (b) 154m

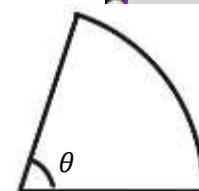
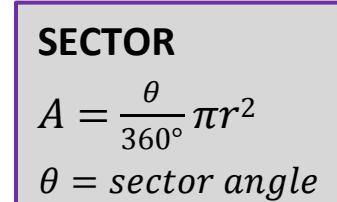
- (c) 88dm

2. Find the diameter of a circle whose circumference is 110cm

SUB TOPIC: Finding area of a circle and parts of a circle



$$A = \frac{1}{4} \pi r^2$$



1. Calculate the area of ;($\pi = \frac{22}{7}$)

(a) A circle whose diameter is 7m.

$$\begin{aligned}A &= \pi r^2 \\&= \frac{22}{7} \times \frac{7m}{2} \times \frac{7m}{2} \\&= 11m \times 7m \\&\quad \underline{\quad 2\quad} \\&= \frac{77}{2} m^2 \\&= 38\frac{1}{2} m^2\end{aligned}$$

(b) A semi circle whose radius is 7cm

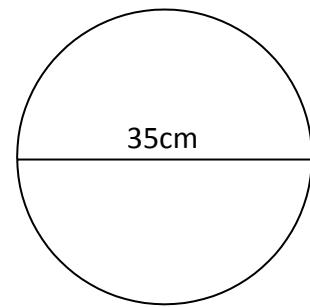
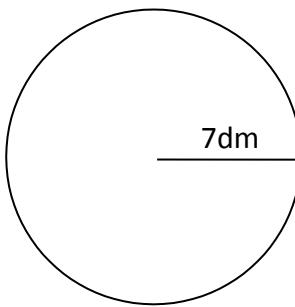
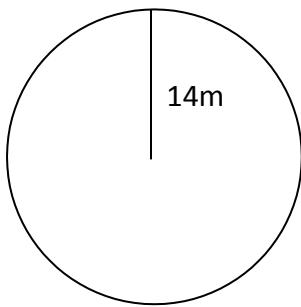
$$\begin{aligned}A &= \frac{1}{2} \pi r^2 \\&= \frac{1}{2} \times \frac{22}{7} \times 7cm \times 7cm \\&= 11cm \times 7cm \\&= 77cm^2\end{aligned}$$

(c) A quadrant whose radius is 14cm

$$\begin{aligned}A &= \frac{1}{4} \pi r^2 \\&= \frac{1}{4} \times \frac{22}{7} \times 14cm \times 14cm \\&= \frac{22}{4} \times 2cm \times 7cm \\&= 11 \times 7cm^2 \\&= 77 cm^2\end{aligned}$$

Activity

1. Find the area of the figure below



2. Find the area of a semi circle whose radius is;

(a) 7cm

(b) 14m

3. Find the area of a quadrant whose radius is:

(a) 21cm

(b) 7dm

Mathematics is the key

SUB TOPIC: Finding radius or diameter when given area

1. The area of a circle is 154cm^2 . Find its radius.

$$\pi r^2 = A$$

$$\frac{22}{7}r^2 = 154\text{m}^2$$

$$\frac{22r^2}{7} = 154\text{m}^2$$

$$7 \times \frac{22r^2}{7} = 154\text{m}^2 \times 7$$

$$22r^2 = 154 \times 7\text{m}^2$$

$$\frac{22r^2}{22} = \frac{154 \times 7\text{m}^2}{22}$$

$$r^2 = 7 \times 7\text{m}^2$$

$$r^2 = \sqrt{49\text{m}^2}$$

$$\underline{\underline{r = 7\text{m}}}$$

2. Find the radius of a circle whose area is;

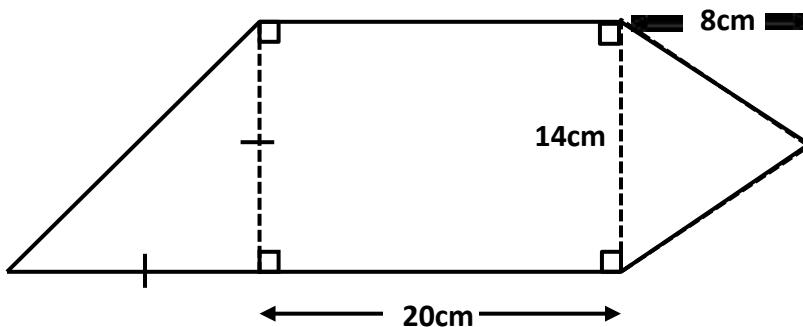
(a) 308dm^2

(b) 1386cm^2

SUB TOPIC: Finding area of the combined shapes

Examples

1. Study the figure below and find its area.



Trapezium

$$\begin{aligned}
 A &= \frac{1}{2} h(a + b) \\
 &= \frac{1}{2} \times 14\text{cm}((14\text{cm} + 20\text{cm}) + \\
 &\quad 20\text{cm}) \\
 &= 7\text{cm} \times 54\text{cm} \\
 &= 378\text{cm}^2
 \end{aligned}$$

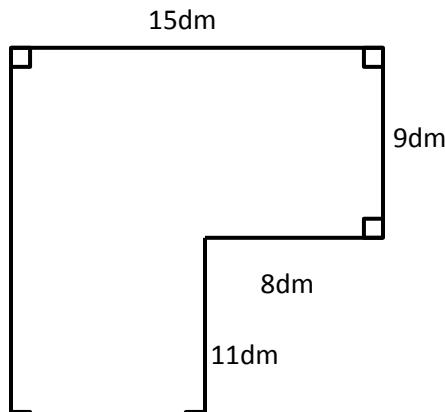
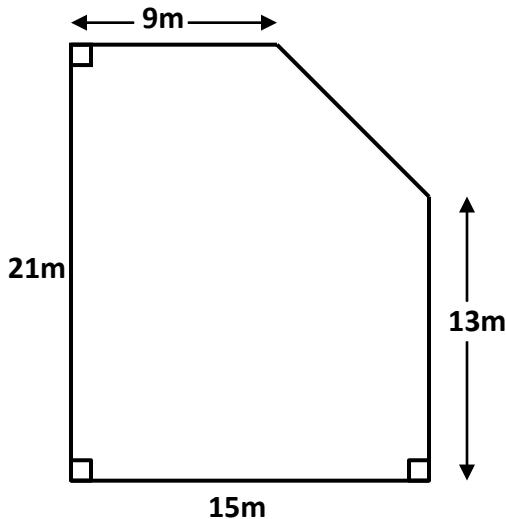
Triangle

$$\begin{aligned}
 A &= \frac{1}{2}bh \\
 &= \frac{1}{2} \times 14\text{cm} \times 8\text{cm} \\
 &= 7 \times 8\text{cm}^2 \\
 &= 56\text{cm}^2
 \end{aligned}$$

total area

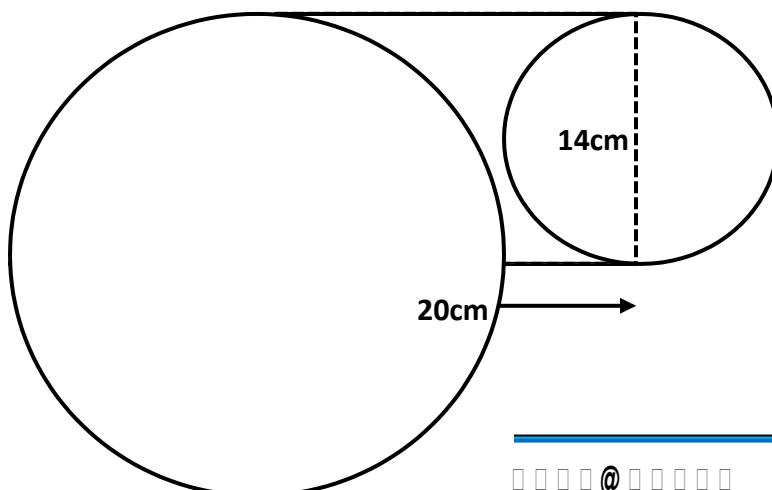
$$\begin{aligned}(378 + 56)cm^2 \\ \underline{434cm^2}\end{aligned}$$

2. Find the area of the figures below



Project work

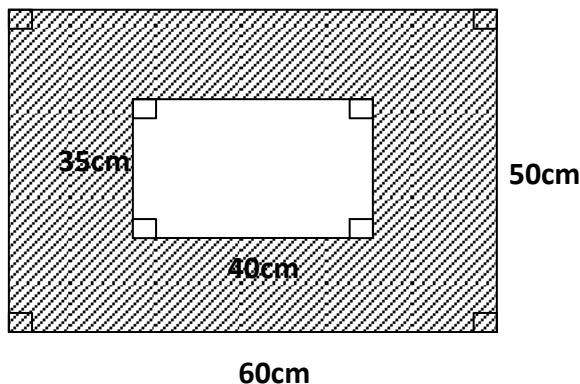
Work out the area of the figure below



SUB TOPIC: Finding shaded area

Examples

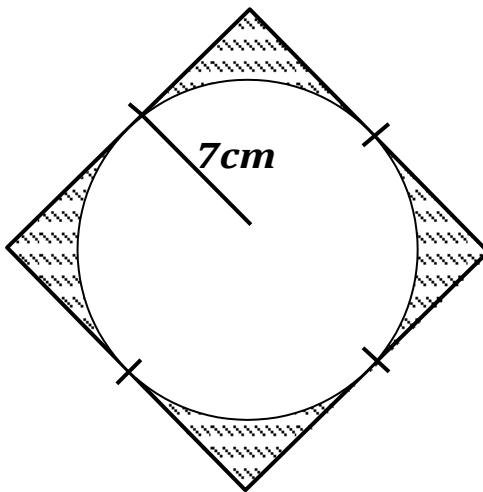
1. Study the figure below and find the shaded area



Shaded area = outer area - inner area

$$\begin{aligned} &= (L \times W) - (L \times W) \\ &= (60\text{cm} \times 50\text{cm}) - (40\text{cm} \times 35\text{cm}) \\ &= 3000\text{cm}^2 - 1400\text{cm}^2 \\ &= \underline{\underline{1600\text{cm}^2}} \end{aligned}$$

2. Study the figure below and use it to answer the questions that follow.



Find the shaded area ($\pi = \frac{22}{7}$)

Square

$$\text{side} = 7\text{cm} + 7\text{cm} = 14\text{cm}$$

$$A = s \times s$$

$$= 14\text{cm} \times 14\text{cm}$$

$$= \underline{\underline{196\text{cm}^2}}$$

circle

$$A = \pi r^2$$

$$= \frac{22}{7} \times 7\text{cm} \times 7\text{cm}$$

$$= 22\text{cm} \times 7\text{cm}$$

$$= \underline{\underline{154\text{cm}^2}}$$

Shaded area

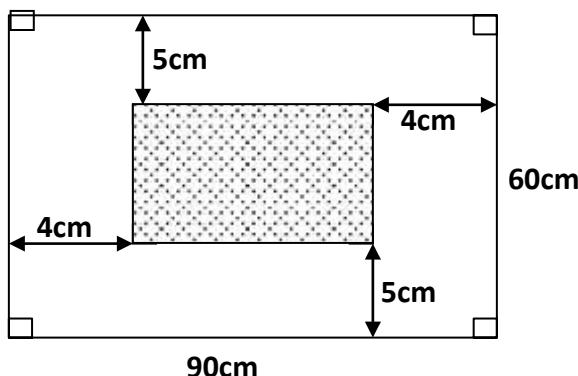
Outer area - Inner area

$$196\text{cm}^2 - 154\text{cm}^2$$

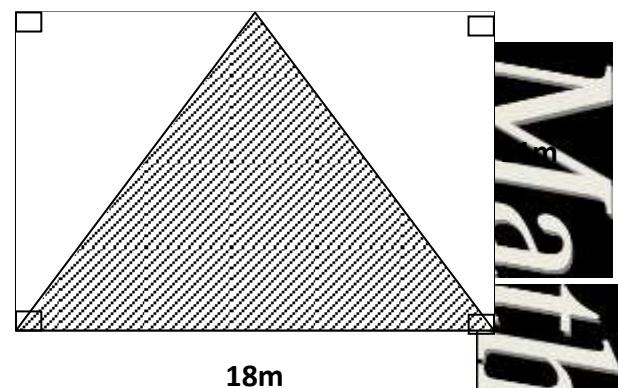
$$= \underline{\underline{42\text{cm}^2}}$$

Mathematics
is the
key

3. A table of size 90cm by 60cm was partly covered with a piece of cloth as shown in the figure below. What part of the table was uncovered?



4. Find the un shaded area



SUB TOPIC: Finding missing sides using Pythagoras' theorem

Pythagoras' theorem states that the sum of the squares of the two shorter sides of a right angled triangle is equal to the square of the hypotenuse.

$3 \times 3 = 9 \text{sq. units}$

$5 \times 5 = 25 \text{sq. units}$

$4 \times 4 = 16 \text{sq. units}$

$16 \text{ squares} + 9 \text{ squares} = 25 \text{ square}$
 $\text{base}^2 + \text{height}^2 = \text{hyp}^2$
 $a^2 + b^2 = c^2$

Mathematics
is the key

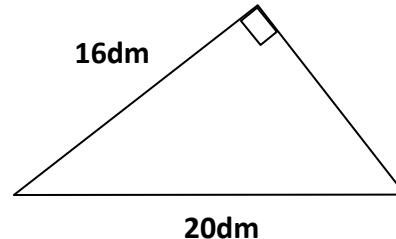
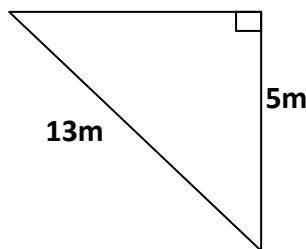
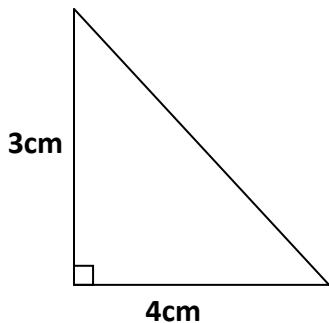
Examples

1. Study the triangles below and find the missing side.

$a^2 + b^2 = c^2$ $6^2 + 8^2 = c^2$ $(6 \times 6) + (8 \times 8) = c^2$ $c^2 = 36 + 64$ $c^2 = 100$ $\sqrt[3]{c^2} = \sqrt[3]{100}$ $c = 10\text{cm}$	$a^2 + b^2 = c^2$ $6^2 + b^2 = 10^2$ $(6 \times 6) + b^2 = (10 \times 10)$ $36 + b^2 = 100$ $b^2 + 36 - 36 = 100 - 36$ $\sqrt[3]{b^2} = \sqrt[3]{64}$ $b = 8\text{cm}$	$a^2 + b^2 = c^2$ $a^2 + 8^2 = 10^2$ $(a^2) + (8 \times 8) = (10 \times 10)$ $a^2 + 64 = 100$ $a^2 + 64 - 64 = 100 - 64$ $\sqrt[3]{a^2} = \sqrt[3]{36}$ $a = 6\text{cm}$
---	--	--

Activity

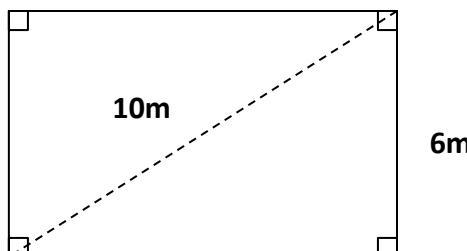
1. Find the missing sides in the following triangles



SUB TOPIC: Application of Pythagoras' theorem

Examples

1. Find the area of the figure below



$$a^2 + b^2 = c^2$$

$$6^2 + b^2 = 10^2$$

$$(6 \times 6) + b^2 = (10 \times 10)$$

$$36 + b^2 = 100$$

$$b^2 + 36 - 36 = 100 - 36$$

$$\sqrt[2]{b^2} = \sqrt[2]{64}$$

$$b = 8m$$

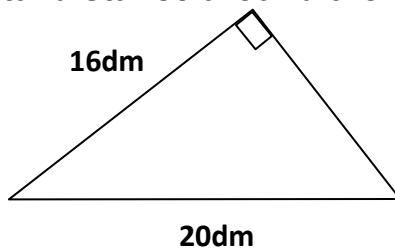
$$\text{length} = 8m$$

$$\text{Area} = L \times W$$

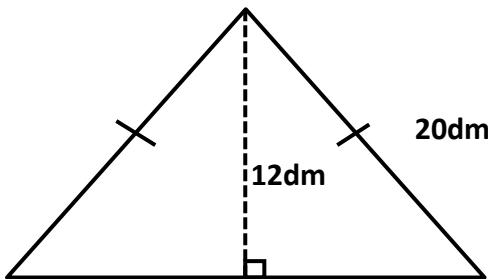
$$= 8m \times 6m$$

$$= 48m^2$$

2. Find the total distance around the figure



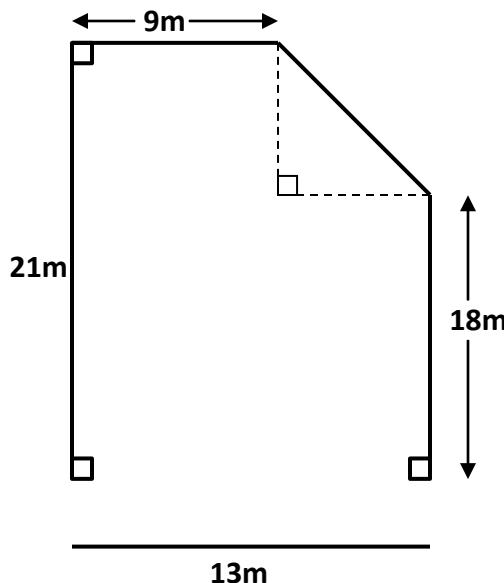
3. The figure below is an isosceles triangle. Use it to answer the questions that follow



(a) Find the area of the figure

(b) A rat moved around the figure 3 times. What distance did it cover?

4. Find the perimeter of the figure below



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VOLUME AND SURFACE AREA

SUB TOPIC: Converting from square centimetres (cm^2) to square metres(m^2) and vice versa.

$$\begin{aligned}1\text{m} &= 100\text{cm} \\1\text{m}^2 &= 1\text{m} \times \\1\text{m} &= 100\text{cm} \times 100\text{cm} \\&= 10,000\text{cm}^2\end{aligned}$$

Examples

- Convert the following as instructed.

(a). 0.5 m^2 to square centimetres.

$$1\text{m}^2 = 10,000\text{cm}^2$$

$$0.5\text{m}^2 = 0.5 \times 10,000\text{cm}^2$$

$$= \underline{\underline{5,000\text{cm}^2}}$$

(b). 8000cm^2 to square metres

$$10,000\text{cm}^2 = 1\text{m}^2$$

$$5000\text{cm}^2 = \frac{5,000\text{cm}^2}{10,000\text{cm}^2} = \frac{1}{2}\text{m}^2$$

- Convert the following to square centimetres.

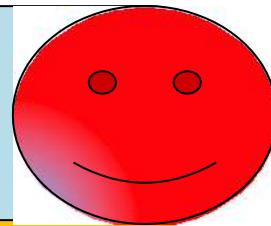
- 2m^2
- 45m^2
- 0.03m^2

- Convert the following to square metres

- $700,000\text{cm}^2$
- $1,200\text{cm}^2$
- $88,800\text{cm}^2$

SUB TOPIC: Converting from square kilometres (km^2) to square metres(m^2) and vice versa.

$$\begin{aligned}1\text{km} &= 1000\text{m} \\1\text{km}^2 &= 1\text{km} \times \\1\text{km} &= 1000\text{m} \times 1000\text{m} \\&= 1,000,000\text{m}^2\end{aligned}$$



Examples

- Convert the following as instructed.

(a). 0.5 km^2 to square metres.

$$1\text{km}^2 = 1,000,000\text{m}^2$$

$$0.5\text{km}^2 = 0.5 \times 1,000,000\text{m}^2$$

$$= \underline{\underline{500,000\text{m}^2}}$$

- $970,000\text{m}^2$ to square kilometres

$$\begin{aligned}1,000,000\text{m}^2 &= 1\text{km}^2 \\970,000\text{m}^2 &= \frac{970,000\text{m}^2}{1,000,000\text{m}^2} \\&= \frac{97}{100}\text{km}^2 \\&= 0.97\text{km}^2\end{aligned}$$

Mathematics - The Key

2. Convert the following to square metres.

- d. 2km^2
- e. 45km^2
- f. 0.03km^2

3. Convert the following to square kilometres

- d. $67,000,000\text{m}^2$
- e. $1,200\text{m}^2$
- f. $88,800\text{m}^2$

SUB TOPIC: Converting from cubic metres (m^3) to cubic centimetres(cm^3) and vice versa.

$$\begin{aligned}1\text{m} &= 100\text{cm} \\1\text{m}^3 &= 1\text{m} \times 1\text{m} \times 1\text{m} \\&= 100\text{cm} \times 100\text{cm} \times 100\text{cm} \\&= 1,000,000\text{cm}^3\end{aligned}$$

Examples

1. Convert the following as instructed.

(a). 0.24 m^3 to cubic centimetres.

$$1\text{m}^3 = 1,000,000\text{cm}^3$$

$$\begin{aligned}0.24\text{m}^3 &= 0.24 \times 1,000,000\text{cm}^3 \\&\equiv 240,000\text{cm}^3\end{aligned}$$

(b). $8,600,000\text{cm}^3$ to cubic metres

$$\begin{aligned}1,000,000\text{cm}^3 &= 1\text{m}^3 \\8,600,000\text{cm}^3 &= \frac{8,600,000\text{cm}^3}{1,000,000\text{cm}^3} \\&= \frac{86}{10} \text{ m}^3 = 8.6\text{m}^3\end{aligned}$$

2. Convert the following to cubic centimetres.

g. $2\frac{1}{2}\text{m}^3$

h. 82m^3

i. 0.63m^3

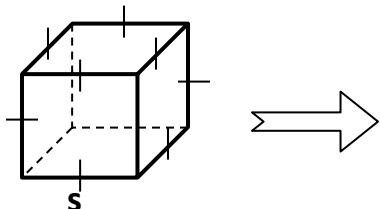
3. Convert the following to square metres

g. $3,900,000\text{cm}^3$

h. $1,600\text{cm}^3$

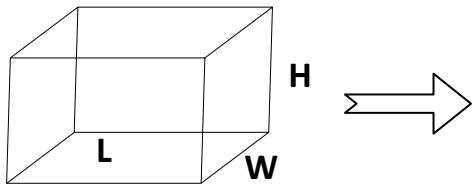
i. $40,800\text{cm}^3$

SUB TOPIC: Volume and capacity of a cube and cuboid



CUBE
 $VOLUME = b \cdot a \times h$
 $VOLUME = (S \times S) \times S$

Key



CUBOID
 $VOLUME = b \cdot a \times h$
 $VOLUME = (L \times W) \times H$

NOTE:

1 litre contains $1000cm^3$

Examples

- Find the volume of a cube whose side is 6m

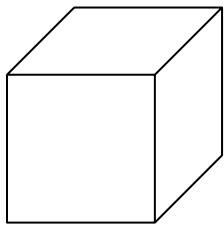
$$\begin{aligned}
 VOLUME &= b \cdot a \times h \\
 &= (S \times S) \times S \\
 &= 6m \times 6m \times 6m \\
 &= 36m^2 \times 6m \\
 &= \underline{\underline{216m^3}}
 \end{aligned}$$

- Calculate the volume and capacity of a cuboid measuring 12cm by 15cm by 20cm.

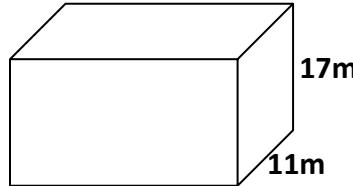
$$\begin{aligned}
 VOLUME &= b \cdot a \times h \\
 &= (L \times W) \times H \\
 &= 12cm \times 15cm \times 20cm \\
 &= 180cm^2 \times 20cm \\
 &= \underline{\underline{3600cm^3}}
 \end{aligned}$$

CAPACITY
 $1000cm^3 = 1\text{litre}$
 $3600cm^3 = \frac{3600cm^3}{1000cm^3} = 3.6\text{ litres}$

- Find the volume of the figures below



9cm



15m

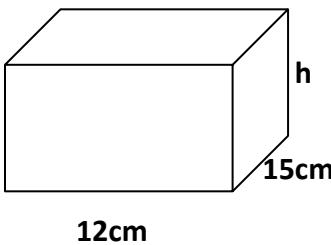
17m
11m

- Find the capacity of a rectangular tank whose dimensions measure 24cm by 16cm by 30cm.

SUB TOPIC: Finding sides when given volume of a cuboid

Examples

- The volume of the figure below is 3600cm^3 . Use it to find the missing side.



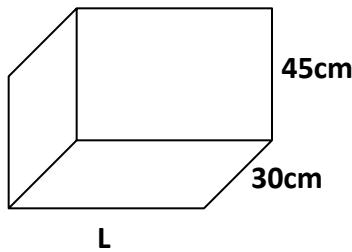
$$b. a \times h = \text{VOLUME}$$

$$(L \times W) \times H = \text{VOLUME}$$

$$12\text{cm} \times 15\text{cm} \times H = 3600\text{cm}^3$$

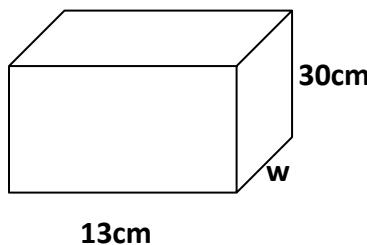
$$\begin{aligned} 12\text{cm} \times 15\text{cm} \times H &= 3600\text{cm}^3 \\ \frac{12\text{cm} \times 15\text{cm}}{12\text{cm} \times 15\text{cm}} &= \frac{3600\text{cm}^3}{12\text{cm} \times 15\text{cm}} \\ H &= 20\text{cm} \end{aligned}$$

- Study the figure below.



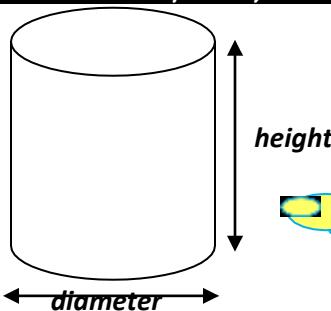
If the figure below holds 27litres, find the value of L

- The volume of a cuboid which measures 6cm by m by 5cm is 210cm^3 . Find the value of m in cm.
- Find the value of w in the figure below given that the volume is 6240cm^3 .



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SUB TOPIC: Volume and capacity of cylinders



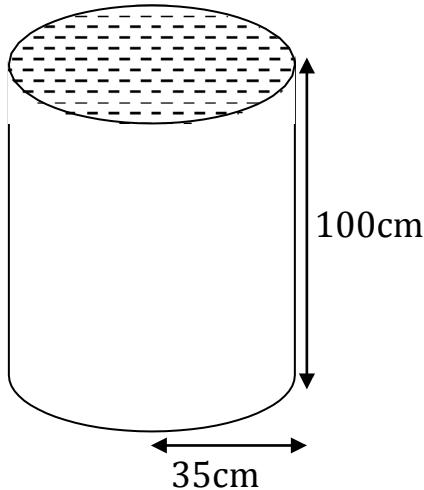
NOTE
1 Litre = 1,000 cm³
Volume = base area x height
 $volume = \pi r^2 h$

Examples

1. Calculate the volume of a cylinder whose radius is 14cm and height is 30cm.

$$\begin{aligned} \text{Volume} &= \pi r^2 h \\ &= \frac{22}{7} \times 14\text{cm} \times 14\text{cm} \times 30\text{cm} \\ &= 22 \times 14\text{cm} \times 2\text{cm} \times 30\text{cm} \\ &= 44 \times 420\text{cm}^3 \\ &= \underline{\underline{18480\text{cm}^3}} \end{aligned}$$

2. Below is a cylindrical tank. Study it and use it to answer the questions that follow.



- (a) Calculate the volume of the tank.

$$\begin{aligned} \text{Volume} &= \pi r^2 h \\ &= \frac{22}{7} \times 35\text{cm} \times 35\text{cm} \times 100\text{cm} \\ &= 22 \times 5\text{cm} \times 35\text{cm} \times 100\text{cm} \\ &= 110 \times 3500\text{cm}^3 \\ &= \underline{\underline{385,000\text{cm}^3}} \end{aligned}$$

Mathematics is the key

Mathematics

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(b). How many litres of water can it hold when full.

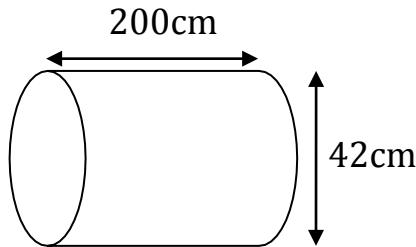
$$1000\text{cm}^3 = 1 \text{ litre}$$

$$385,000\text{cm}^3$$

$$385,000\text{cm}^3 = \frac{385,000}{1,000}\text{cm}^3$$

$$= 385 \text{ Litres}$$

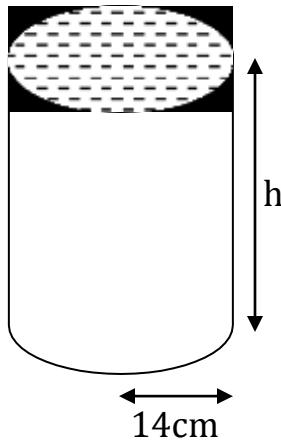
3. Find the volume of a cylinder whose;
- (a) radius is 14cm and height is 40cm
 - (b) radius is 21cm and height is 60cm
 - (c) diameter is 14m and height is 24m
4. Find the capacity of the figure below.



SUB TOPIC: Finding missing sides volume and capacity of cylinders

Examples

1. The volume of the cylinder below is 18480cm^3 . Find the value of h.



$$\pi r^2 h = \text{Volume}$$

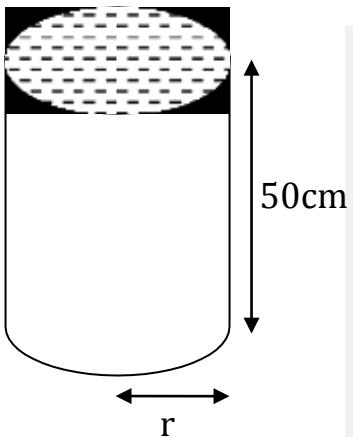
$$\frac{22}{7} \times 14\text{cm} \times 14\text{cm} \times h = 18480\text{cm}^3$$

$$44\text{cm} \times 14\text{cm} \times h = 18480\text{cm}^3$$

$$\frac{44\text{cm} \times 14\text{cm} \times h}{44\text{cm} \times 14\text{cm}} = \frac{18480\text{cm}^3}{44\text{cm} \times 14\text{cm}}$$

$$h = 30\text{cm}$$

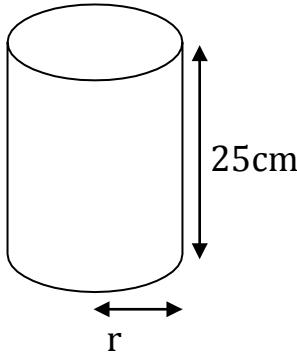
2. The tank below holds 123.2 litres of water when full. Find its radius



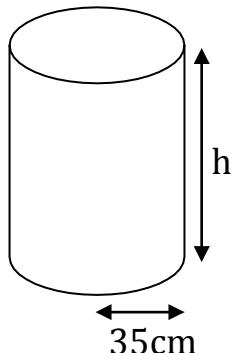
$$\begin{aligned}
 & \pi r^2 h = \text{capacity} \\
 & \frac{22}{7} \times r \times r \times 50\text{cm} = 123.2\text{ l} \\
 & \frac{22}{1000\text{cm}^3} \times r \times r \times 50\text{cm} \\
 & 1000\text{cm}^3 \times \frac{22}{1000\text{cm}^3} \times r \times r \times 50\text{cm} = 123.2 \times 1000\text{cm}^3 \\
 & 1100\text{cm}r^2 \\
 & 7 \times \frac{1100\text{cm}r^2}{7} = 123200\text{cm}^3 \times 7 \\
 & 1100\text{cm}r^2 = 123200\text{cm}^3 \times 7 \\
 & \frac{1100\text{cm}r^2}{1100\text{cm}} = \frac{123200\text{cm}^3 \times 7}{1100\text{cm}} \\
 & r^2 = 784\text{cm}^2 \\
 & \sqrt{r^2} = \sqrt{784\text{cm}^2} \\
 & r = 28\text{cm}
 \end{aligned}$$

Try These

- Find the height of a cylinder whose radius 7cm and volume is 1540cm^3 .
- The volume of the figure below is 3850cm^3 . Find its radius



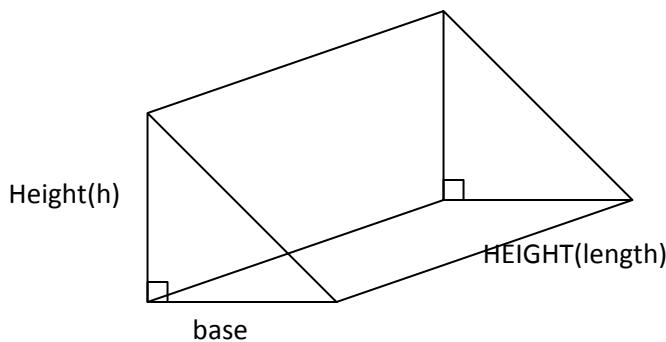
- The cylindrical tank below holds 385 litres.



Find the value of h .

Mathematics is the key

SUB TOPIC: Volume and capacity of triangular prisms



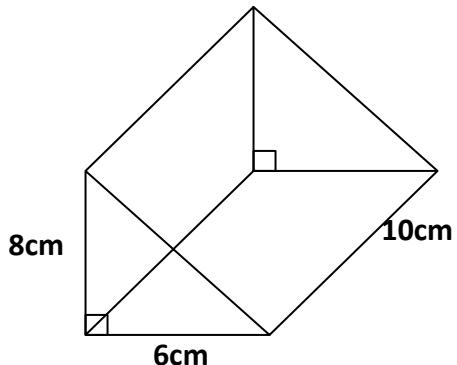
Volume = base area \times height

$$\text{Volume} = \frac{1}{2}bh \times l$$

$$\text{volume} = \frac{1}{2}bhl$$

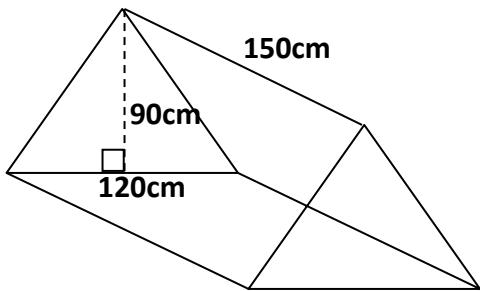
Examples

- Find the volume of the figure below



$$\begin{aligned}\text{Volume} &= \frac{1}{2}bhl \\ &= \frac{1}{2} \times 6\text{cm} \times 8\text{cm} \times 10\text{cm} \\ &= 3 \times 80\text{cm}^3 \\ &= 240\text{cm}^3\end{aligned}$$

- Calculate the capacity of the figure below.



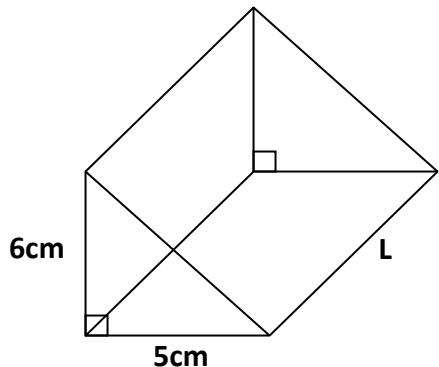
$$\begin{aligned}\text{Volume} &= \frac{1}{2}bhl \\ &= \frac{1}{2} \times 120\text{cm} \times 90\text{cm} \times 150\text{cm} \\ &= 60 \times 90 \times 150\text{cm}^3 \\ &= 5400 \times 150\text{cm}^3 \\ &\equiv 810,000\text{cm}^3 \\ 1000\text{cm}^3 &= 1\text{litre} \\ 810,000\text{cm}^3 & \\ 1,000\text{cm}^3 & \\ 810 &\text{ litres}\end{aligned}$$

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SUB TOPIC: Finding missing sides of a triangular prism when given volume.

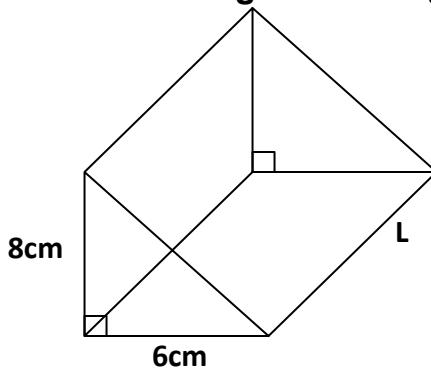
Examples

1. Find the missing side in the figure below given that its volume is 135cm^2



$$\begin{aligned}\frac{1}{2} bhl &= \text{Volume} \\ \frac{1}{2} \times 5\text{cm} \times 6\text{cm} \times L &= 135\text{cm}^3 \\ 3\text{cm} \times 5\text{cm} \times L &= 135\text{cm}^3 \\ \frac{3\text{cm} \times 5\text{cm}}{3\text{cm} \times 5\text{cm}} \times L &= \frac{135\text{cm}^3}{3\text{cm} \times 5\text{cm}} \\ L &= 9\text{cm}\end{aligned}$$

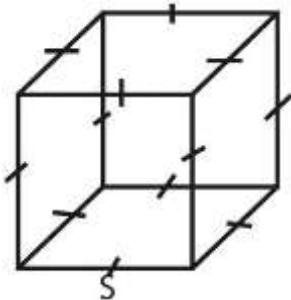
2. Find the value of L in the figure below given that the volume is 240cm^3



SUBTOPIC: Total surface area of cubes and cuboids

Total surface area is the area of all faces

CUBE



A cube has six equal faces of which they are all squares.

Area of a square is ($S \times S$)

$$TSA = 6 \times S \times S$$

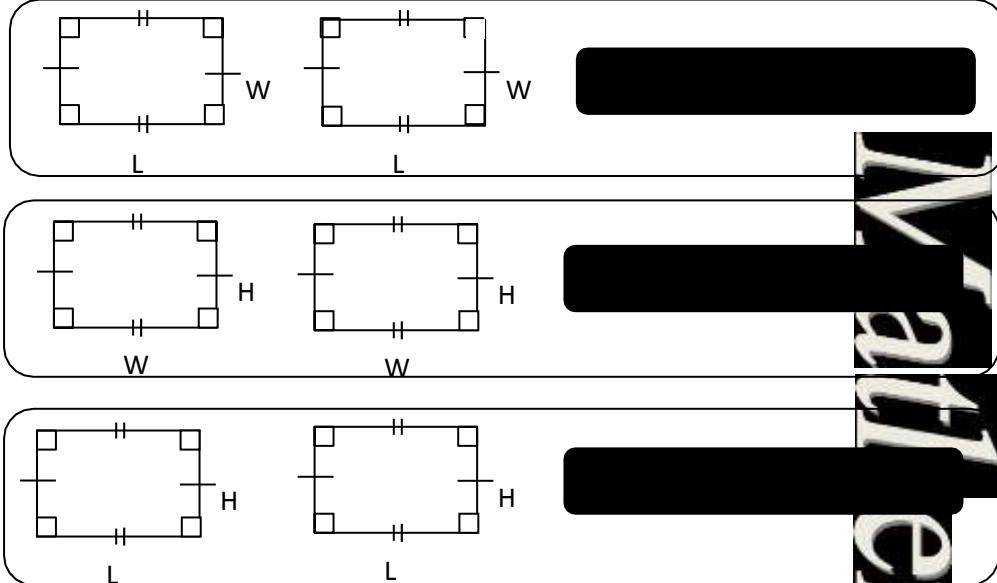
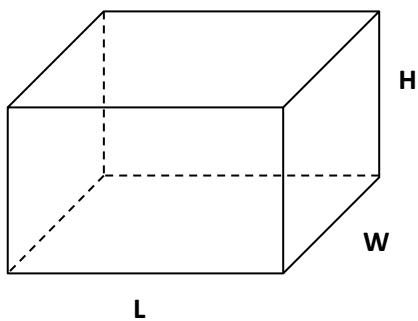
$$TSA = 6 \times S^2$$

$$TSA = 6S^2$$

Mathematics

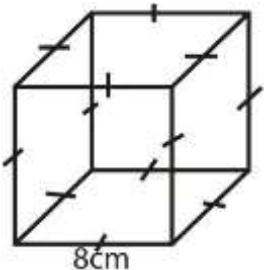
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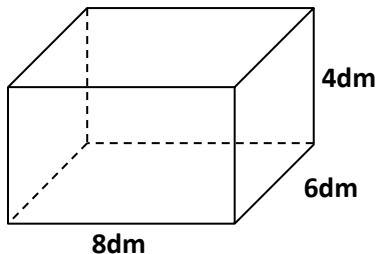


$$TOTAL\ SURFACE\ AREA = 2(L \times W) + 2(W \times H) + 2(L \times H)$$

1. Find the total surface area of the figures below.



$$\begin{aligned}TSA &= 6 \times S \times S \\&= 6 \times 8\text{cm} \times 8\text{cm} \\&= 6 \times 64\text{cm}^2 \\&\equiv \underline{\underline{384\text{cm}^2}}\end{aligned}$$



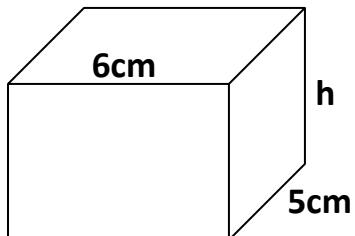
$$\begin{aligned}TSA &= 2(L \times W) + 2(W \times H) + 2(L \times H) \\&= 2(8\text{dm} \times 6\text{dm}) + 2(8\text{dm} \times 4\text{dm}) + 2(6\text{dm} \times 4\text{dm}) \\&= 2 \times 48\text{dm}^2 + 2 \times 32\text{dm}^2 + 2 \times 24\text{dm}^2 \\&= 96\text{dm}^2 + 64\text{dm}^2 + 48\text{dm}^2 \\&\equiv \underline{\underline{208\text{dm}^2}}\end{aligned}$$

2. Find the total surface area of the box measuring 10cm by 5cm by 4cm.
3. Find the total surface of the cube whose side is 10cm.

SUBTOPIC: Finding missing sides when given TSA of a cuboid.

Examples

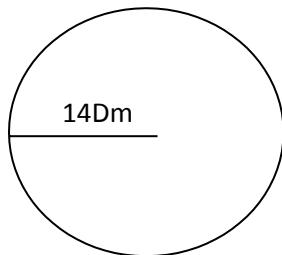
The total surface area of a cuboid is 148cm^2 . Find the value of h .



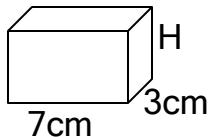
$$\begin{aligned}2(L \times W) + 2(W \times H) + 2(L \times H) &= \text{TSA} \\2(6\text{cm} \times 5\text{cm}) + 2(5\text{cm} \times h) + 2(6\text{cm} \times h) &= 148\text{cm}^2 \\2 \times 30\text{cm}^2 + 2 \times 5h\text{cm} + 2 \times 6h\text{cm} &= 148\text{cm}^2 \\60\text{cm}^2 + 10h\text{cm} + 12h\text{cm} &= 148\text{cm}^2 \\22h\text{cm} + 60\text{cm}^2 &= 148\text{cm}^2 \\22h\text{cm} + 60\text{cm}^2 - 60\text{cm}^2 &= 148\text{cm}^2 - 60\text{cm}^2 \\22h\text{cm} &= 88\text{cm}^2 \\22h\text{cm} &= \frac{88\text{cm}^2}{22\text{cm}} \\h &= 4\text{cm}\end{aligned}$$

TOPICAL QUESTIONS

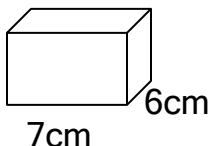
1. How many centimeters are in 0.75 metres?
2. Find the circumference of a circle whose radius is 21cm
3. Find the area of the circle below.



4. The circumference of a circle is 88m. Find the radius of the circle (Use $\pi = \frac{22}{7}$)
5. A cylindrical tank is 7m high. What is the capacity (in litres) of the tank if its radius is 7m?
6. The volume of the figure below is 105cm^3 . Find its height.



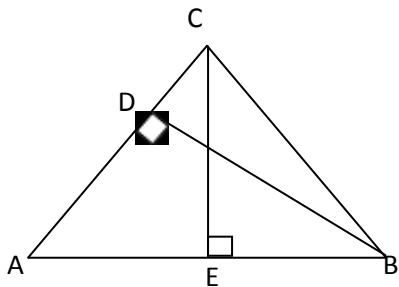
7. Find the base area of the figure below.



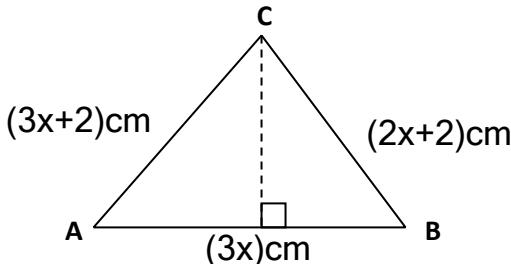
Mathematics

is the key

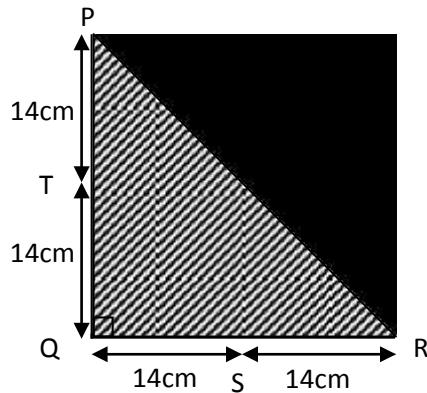
8. In the triangle below, $AB = 12\text{cm}$, $CE = 10\text{cm}$ and $AC = 16\text{cm}$. Find the length of BD in cm.



9. The figure ABC below is an isosceles triangle. Use it to answer the questions that follow.



- (a) Find the value of x .
 - (b) Find the area of triangle ABC
 - (c) Calculate the perimeter of the triangle.
 - (d) Find the circumference of a circular compound whose radius is 14m.
(take $\pi = \frac{22}{7}$)
10. In the figure below, $PQ = QR = 28\text{cm}$ use it to answer the questions that follow.

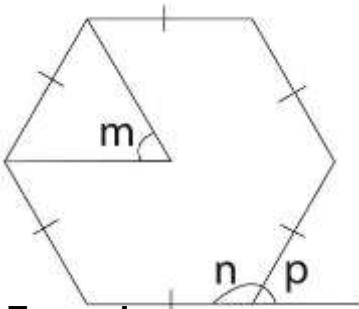


- (a) Find the area of triangle PQR.
- (b) What is the area of the shaded part?

LINES, ANGLES AND GEOMETRICAL FIGURES

SUB TOPIC: Names of polygons

SUBTOPIC: interior and exterior angles of a polygon



Examples

1. The exterior angle of a regular polygon is 36° . Find the size of the interior angle.

Let the interior angle be m

$$m + 36^\circ = 180^\circ$$

$$m + 36^\circ - 36^\circ = 180^\circ - 36^\circ$$

$$\underline{m = 144^\circ}$$

2. The interior angle of a regular polygon is 115° . find the size of its exterior angle.

Let the exterior angle be m

$$m + 115^\circ = 180^\circ$$

$$m + 115^\circ - 115^\circ = 180^\circ - 115^\circ$$

$$\underline{m = 65^\circ}$$

3. Find the size of the exterior angle of a polygon whose interior angle is;

(a) 120°

(b) 80°

4. Find the size of an interior angle of a polygon whose exterior angle is 45° .

SUB TOPIC: Calculating the number of sides of a polygon

Examples:

1. Calculate the number of sides of a regular polygon whose exterior angle is 30° .

$$\text{Number of sides} = \frac{360^\circ}{\text{each ext angle}}$$

$$= \frac{360^\circ}{30^\circ}$$

$$\underline{\text{No of sides} = 12 \text{ sides.}}$$

2. The interior angle of a regular polygon is 144° . Name the polygon.
Let the ext angle be x.

$$\text{No of side} = \frac{360^\circ}{36^\circ}$$

$$= 10 \text{ sides}$$

The polygon is a decagon

$$X = 36^\circ$$

$$\underline{\text{Exterior angle} = 36^\circ}$$

3. The interior angle of a regular polygon is 90° more than the exterior angle.

- (a) Calculate the exterior angle

Let the ext. angle be x

$$\text{Int. angle} = x + 90^\circ$$

Ext. angle x

$$x + 90^\circ + x = 180^\circ$$

$$2x + 90^\circ - 90^\circ = 180^\circ - 90^\circ$$

$$\underline{2x = 90}$$

$$\underline{2} \quad \underline{2}$$

$$x = 45^\circ$$

$$\underline{\text{ext. angle} = 45^\circ}$$

- (b) How many sides has the polygon?

$$\text{No of sides} = \frac{360^\circ}{45^\circ}$$

$$= 8$$

$$\underline{\underline{= 8 \text{ sides}}}$$

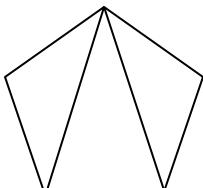
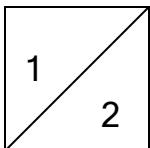
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Calculate the number of sides of a polygon whose exterior angle is;

- (a) 36°
- (b) 45°
- (c) 60°

SUB TOPIC: Triangulation

Triangulation is forming triangles in a polygon.



Quadrilateral

Pentagon

$$\text{Number of triangles} = n - 2$$

Polygon	Number of sides	Number of triangles
Quadrilateral	4	$4 - 2 = 2$ triangles
Pentagon	5	$5 - 2 = 3$ triangles
Hexagon	6	$6 - 2 = 4$ triangles
Heptagon	7	$7 - 2 = 5$ triangles

Examples:

- How many triangles can be formed in a polygon with 8 sides?

$$\begin{aligned} \text{No of triangles} &= n - 2 \\ &= 8 - 2 \\ &\underline{\underline{= 6 \text{ triangles}}} \end{aligned}$$

- Calculate the number of triangles of;

- (a) A 6 sided polygon
- (b) A duo decagon
- (c) A 20 sided polygon

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SUB TOPIC: Number of right angles

Each triangle contains two right angles.

Number of right angles = $2(n - 2)$

$$\underline{= 2n - 4}$$

Polygon	Number of sides	Number of triangles	Number of right angles
Quadrilateral	4	$4 - 2 = 2$ triangles	$2 \times 2 = 4$ right angles
Pentagon	5	$5 - 2 = 3$ triangles	$3 \times 2 = 6$ right angles
Hexagon	6	$6 - 2 = 4$ triangles	$4 \times 2 = 8$ right angles
Heptagon	7	$7 - 2 = 5$ triangles	$5 \times 2 = 10$ right angles

Examples:

- How many right angles can be formed in a polygon with 8 sides?

$$\text{No. of right angles} = 6 \times 2$$

$$\underline{\underline{= 12 \text{ right angles}}}$$

- Calculate the number of right angles of a polygon with 11 triangles.

$$\text{No. of right angles} = 2 \times 11$$

$$\underline{\underline{22 \text{ right angles}}}$$

- Calculate the number right angles of;

(a) A 6 six sided polygon

(b) A duo decagon

(c) A 20 sided polygon

(d) A polygon with 15 triangles

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SUB TOPIC: Finding number of sides of a polygon when given number of triangles or right angles

- If 10 triangles can be formed in regular polygon, find the number of sides of the polygon.

$$\text{No. of triangles} = n - 2$$

$$n - 2 = 10$$

$$n - 2 + 2 = 10 + 2$$

$$\underline{\underline{n = 12 \text{ sides}}}$$

2. Find the number of sides of a polygon with 16 triangles

$$2(n - 2) = \text{no. of right angles}$$

$$2n - 4 = 16$$

$$2n - 4 + 4 = 16 + 4$$

$$2n = 20$$

$$\frac{2n}{2} = \frac{20}{2}$$

$$\underline{\underline{n = 10 \text{ sides}}}$$

3. Find the number of sides of a polygon with;

(a) 10 right triangles

(b) 4 triangles

4. Name the polygon with;

(a) 8 triangles

(b) 18 right angles

Mathematics

SUB TOPIC: THE SUM OF INTERIOR ANGLES OF A REGULAR POLYGON (interior angle sum)

$$\text{Interior angle sum} = 180^\circ(n - 2) \text{ or } 90^\circ(2n - 4)$$

Examples:

1. The interior angle of a regular pentagon is 108° . Calculate the sum of all interior angles of the polygon.

A pentagon has 5 sides.

$$\text{Each int. angle} = 108^\circ$$

$$\begin{aligned}\text{The sum of interior angles} &= 108^\circ \times 5 \\ &= \underline{\underline{540^\circ}}\end{aligned}$$

is the
key

2. Calculate the interior angle sum of a regular polygon with 7 sides.

$$\begin{aligned}\text{Int. angle sum} &= 180^\circ(n - 2) \\ &= 180^\circ(7 - 2) \\ &= 180^\circ \times 5 \\ &= \underline{\underline{900^\circ}}\end{aligned}$$

3. Each exterior angle of a polygon is 30° . Calculate the sum of the interior angles of a polygon.

$$\begin{aligned}\text{No. of sides} &\\ 360^\circ &\\ \underline{30^\circ} &\\ \underline{\underline{12 \text{ sides}}}\end{aligned}$$

The sum of int. angles

$$\begin{aligned}&180^\circ(n - 2) \\ &180^\circ(12 - 2) \\ &180^\circ \times 10 \\ &\underline{\underline{1800^\circ}}\end{aligned}$$

Key

4. Find the sum of interior angles of ;
- A polygon with 8sides
 - A polygon with 18sides
 - A heptagon
 - A polygon with 15 sides

SUB TOPIC: Finding number of sides when given interior angle sum

1. The sum of interior angles of a regular polygon is 1440° .
 (a) How many sides has the polygon?

$$180^\circ(n - 2) = \text{int. angle sum}$$

$$180^\circ(n - 2) = 1440^\circ$$

$$\frac{180^\circ(n - 2)}{180^\circ} = \frac{1440^\circ}{180^\circ}$$

$$n - 2 = 8$$

$$n - 2 + 2 = 8 + 2$$

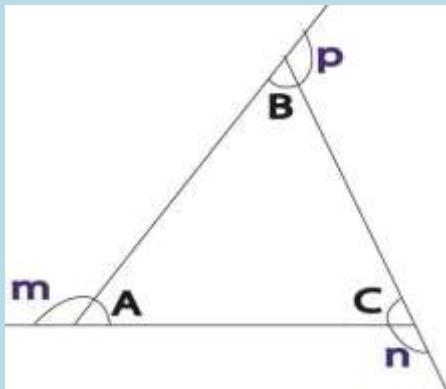
$$\underline{n = 10 \text{ sides}}$$

- (b) What is the size of each exterior angle of the polygon?

$$360^\circ \div 10 = 36^\circ$$

2. Calculate the number of sides of a polygon whose interior angle sum is;
- 1800°
 - 540°
 - 720°

SUB TOPIC: ANGLES OF TRIANGLES

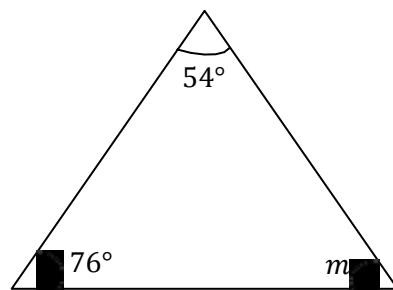


$$A + B + C = 180^\circ$$

Mathematics is key

Examples

1. Find the missing angle

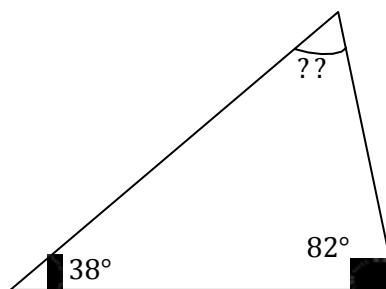
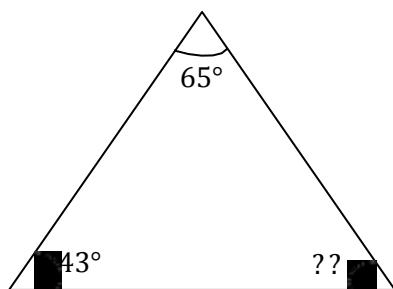


$$m + 76^\circ + 54^\circ = 180^\circ$$

$$m + 130^\circ = 180^\circ$$

$$m + 130^\circ - 130^\circ = 180^\circ - 130^\circ$$

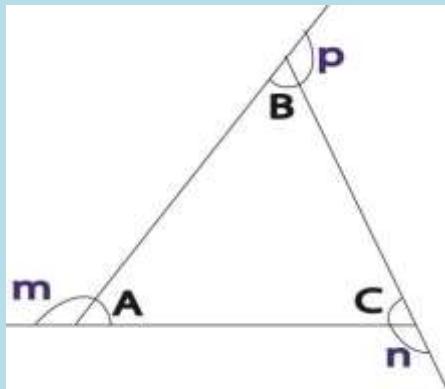
$$\underline{\underline{m = 50^\circ}}$$



Mathematics
Key

SUB TOPIC: Interior and exterior angles of a triangle

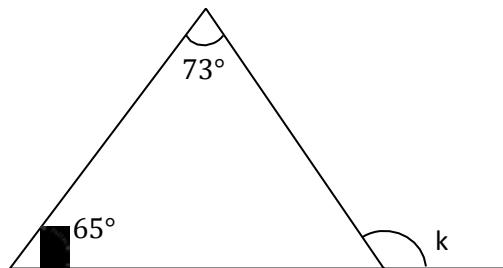
Angle properties of triangles



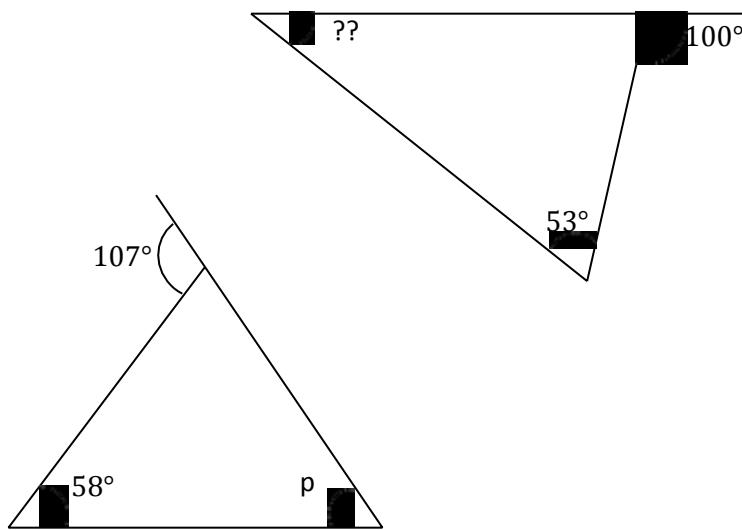
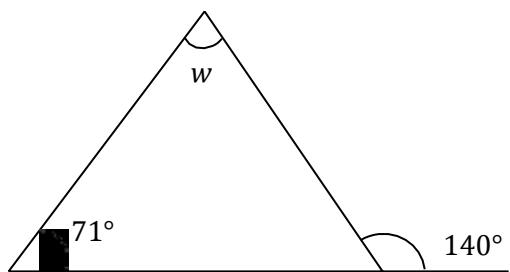
Two interior angles of a triangle add up to one opposite exterior angle

Examples

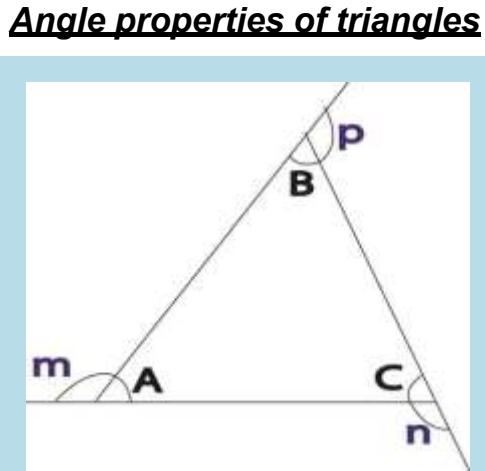
1. Find the missing angle in the figures below



$$k = 65^\circ + 73^\circ$$
$$\underline{\underline{k = 138^\circ}}$$



SUB TOPIC: exterior angles of a triangle



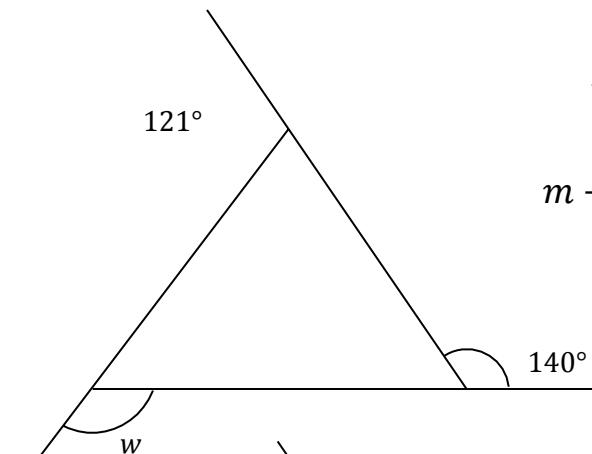
Exterior angles of every polygon add up to 360°

Mathematics is

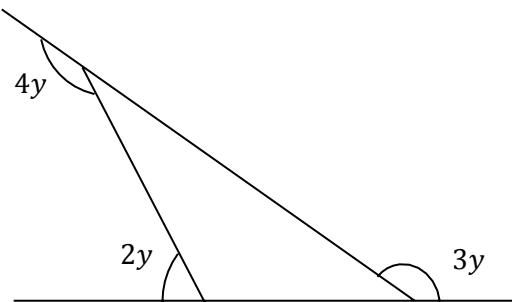
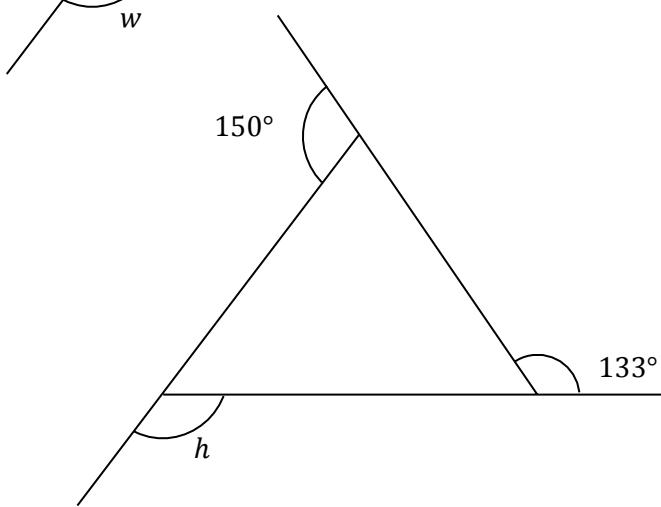
Key

Try these

1. Find the value of the unknown in degrees.

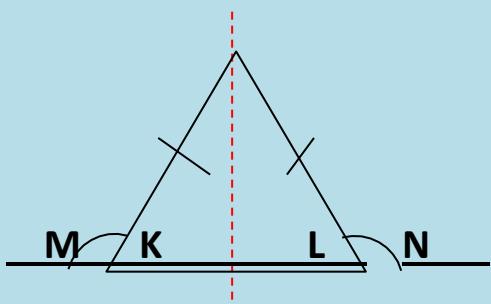


$$\begin{aligned}
 w + 140^\circ + 121^\circ &= 360^\circ \\
 m + 261^\circ &= 360^\circ \\
 m + 261^\circ - 261^\circ &= 360^\circ - 261^\circ \\
 \underline{\underline{m = 99^\circ}}
 \end{aligned}$$



SUB TOPIC: exterior angles of a triangle

Angle properties of triangles



- ❖ Two sides are equal
 - ❖ It has one line of symmetry
 - ❖ Base angles are equal
- $$\angle K = \angle L$$
- $$\angle M = \angle N$$

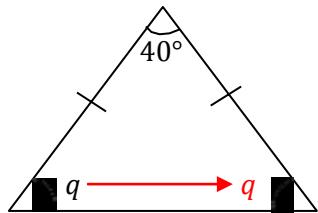
Mathematics

is the

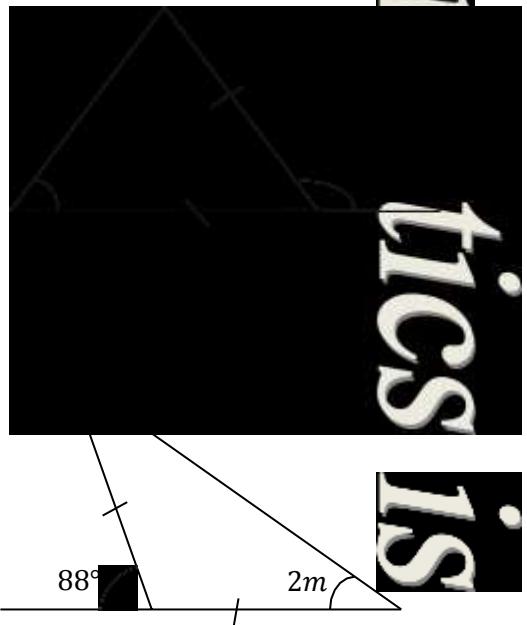
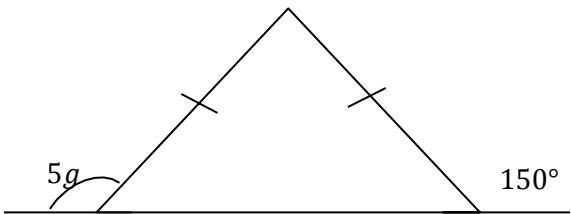
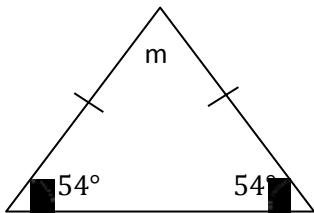
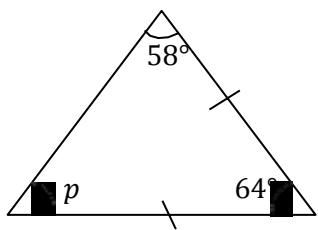
Key

Examples

- Find the value of the unknown in degrees.



$$\begin{aligned}q + q + 40^\circ &= 180^\circ \\2q + 40^\circ &= 180^\circ \\2q + 40^\circ - 40^\circ &= 180^\circ - 40^\circ \\2q &= 140^\circ \\\frac{2q}{2} &= \frac{140^\circ}{2} \\q &= 70^\circ\end{aligned}$$



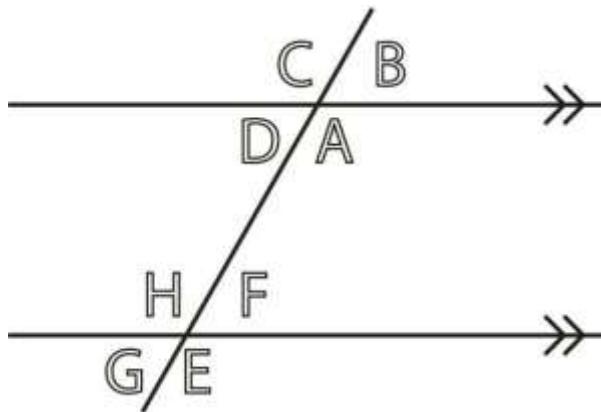
Key

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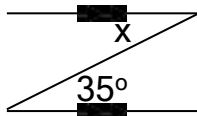
SUB TOPIC: ANGLES ON PARALLEL LINES

Properties of angles on parallel lines

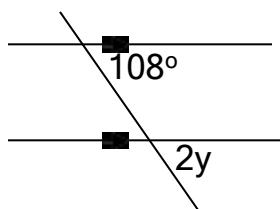


- $A + B = 180^\circ$ (supp. $\angle S$)
- $A = C$ (vertically opp $\angle S$)
- $A = E$ (corresp $\angle S$)
- $D = G$ (corresp $\angle S$)
- $B = F$ (corresp $\angle S$)
- $C = H$ (corresp $\angle S$)
- $A = H \& D = f$ (alt. Int $\angle S$)
- $G = B \& C = E$ (Alt. ext. $\angle S$)
- $A + F = 180^\circ$ (co.int. $\angle S$)
- $D + H = 180^\circ$ (co.int. $\angle S$)
- $C + G = 180^\circ$ (co.ext. $\angle S$)
- $B + E = 180^\circ$ (co.ext. $\angle S$)
- $H = E$ (vertically opp. $\angle S$)
- $A + B + C + D = 360^\circ$ ($\angle S$ at a point)

1. Solve for the unknowns



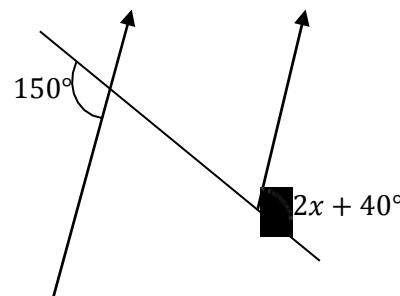
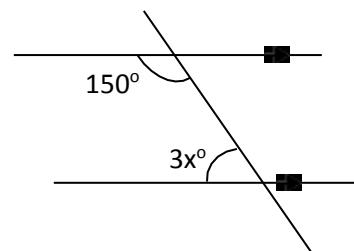
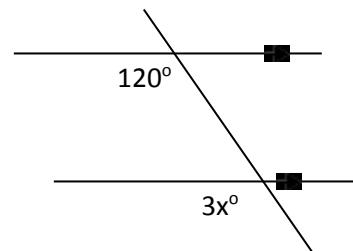
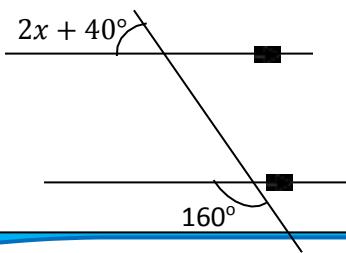
$$X = 350 \text{ (Alt, int } \angle S\text{)}$$



$$2y = 108^\circ \text{ (corr. } \angle S\text{)}$$

$$\frac{2y}{2} = \frac{108^\circ}{2}$$

$$y = 54^\circ$$

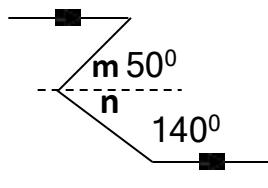
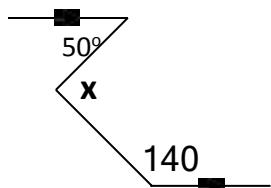


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SUB TOPIC: More about angles on parallel lines

Examples:

1. Find the value of x .



Imaginary lines

Draw imaginary lines

$$m = 50^\circ \text{ (Alt. int } \angle S)$$

$$n + 140^\circ = 180^\circ \text{ (Co. int. } \angle S)$$

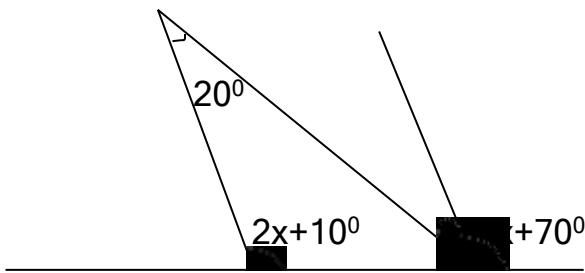
$$n + 140^\circ - 140^\circ = 180^\circ - 140^\circ$$

$$n = 40^\circ$$

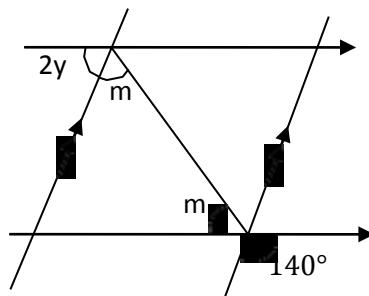
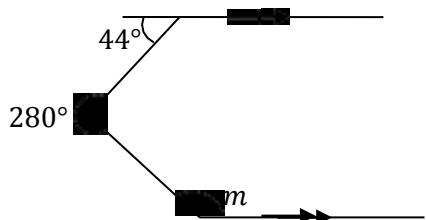
$$x = 40^\circ + 50^\circ$$

$$x = 90^\circ$$

2. Find the value of x and k



3. Find the value of the unknowns in degrees



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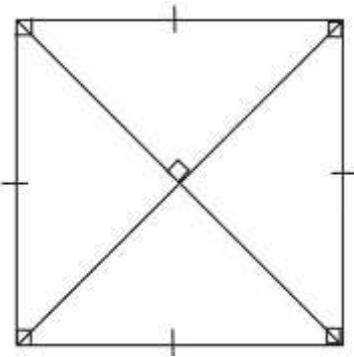
SUB TOPIC: Properties of quadrilaterals

A quadrilateral is a figure with 4 sides.

Examples of quadrilaterals

- **Square**
- **Kite**
- **Parallelogram**
- **Rectangle**
- **Rhombus**
- **Trapezium**

SQUARE

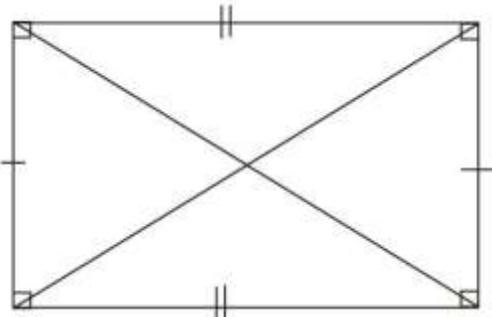


- All sides are equal.
- It has 4 right angles.
- Opposite sides are parallel.
- Diagonals are equal and they bisect each other at a right angle.
- It has 4 lines of folding symmetry.
- Diagonals bisect each angle at every vertex.
- Opposite angles are equal.

Remember:

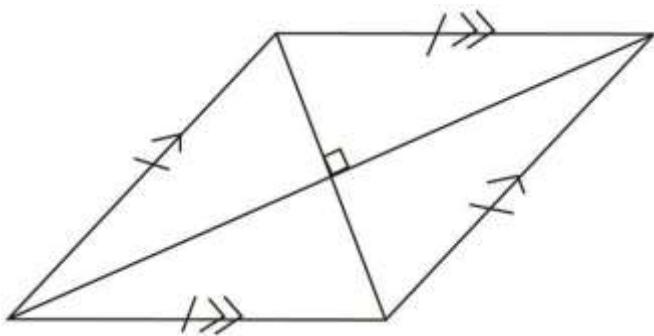
A square is a regular quadrilateral.

RECTANGLE



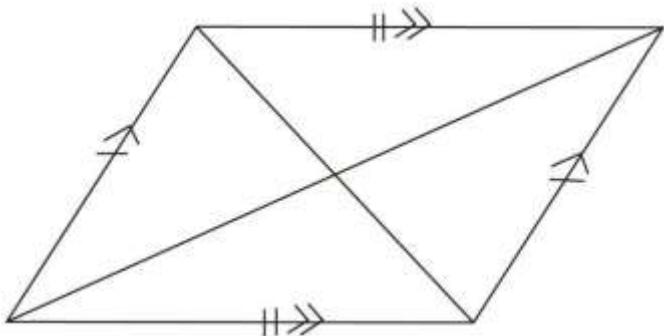
- Opposite sides are equal and parallel.
- It has 4 right angles.
- Diagonals are equal and they bisect each other.
- Diagonals do not meet at right angle.
- It has 2 lines of folding symmetry.
- Opposite angles are equal.

RHOMBUS



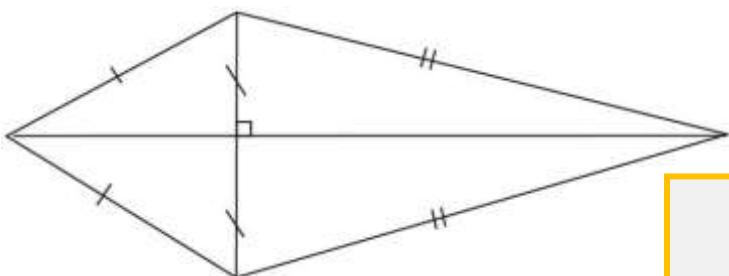
- All sides are equal
- Opposite sides are parallel.
- Diagonals are not equal and they bisect each other at a right angle.
- Diagonals bisect each angle at every vertex.
- It has 2 lines of folding symmetry.
- Opposite angles are equal.

PARALLELOGRAM



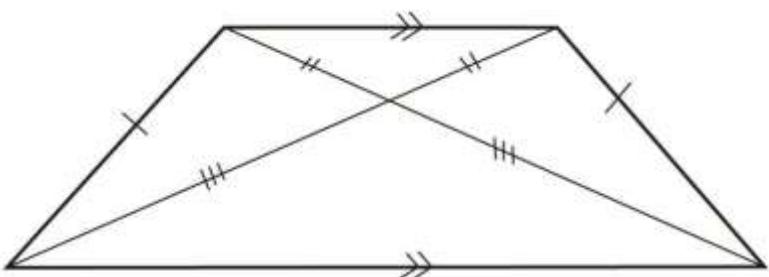
- Opposite sides are equal and parallel.
- Diagonals are not equal and they bisect each other.
- Diagonals do not bisect each angle at every vertex.
- It has no lines of folding symmetry
- Opposite angles are equal.

KITE

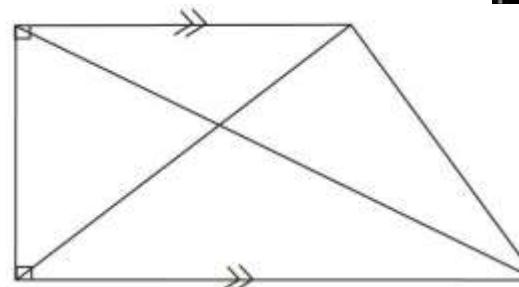


- Adjacent sides are equal.
- Diagonals are not equal and they meet each other at a right angle.
- The longer diagonal bisects the shorter diagonal and the angles at the vertices.
- It has 1 line of folding symmetry.
- Opposite angles are equal.

TRAPEZIUM



Isosceles trapezium



Right angled trapezium

Mathematics is the

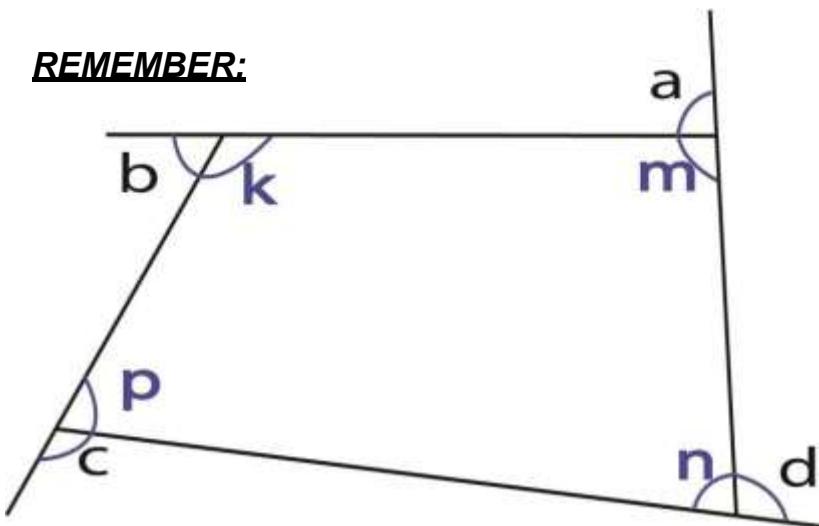
ISOSCELES TRAPEZIUM

- Two of the sides are parallel.
- Diagonals are equal but they do not bisect each other.
- Diagonals do not bisect angles in the vertices.
- Opposite angles are not equal.
- It has 1 line of folding symmetry.
- Opposite angles are not equal.

RIGHT ANGLED TRAPEZIUM

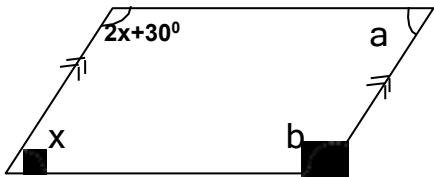
- Two of the sides are parallel.
- Diagonals are not equal and they do not bisect each other.
- Diagonals do not bisect angles in the vertices.
- Opposite angles are not equal.
- It has no lines of folding symmetry.
- Opposite angles are equal.

REMEMBER:



- Interior angle sum of a quadrilateral is 360°
 $k + m + n + p = 360^\circ$
- Exterior angle sum of every polygon is 360°
 $a + b + c + d = 360^\circ$

1. Calculate the size of angles x, b, a



SUB TOPIC: Complementary angles

An angle with 90° is called a right angle.

Any two angles that add up to 90° are complementary angles.

Examples:

- ii. What is the complement of 30° ?

Let the complement be x

$$X + 30^{\circ} = 90^{\circ}$$

$$X + 30 - 30 = 90 - 30$$

$$\underline{X = 60}$$

- iii. Find the complement of $(x + 40)^{\circ}$

$$90^{\circ} - (x + 40)^{\circ}$$

$$90^{\circ} - x^{\circ} - 40^{\circ}$$

$$90^{\circ} - 40^{\circ} - x^{\circ}$$

$$\underline{(50 - x)^{\circ}}$$

- iv. What angle is $\frac{1}{2}$ of its complement?

Let the angle be k

ANGLE	COMPL.	TL
k	$2k$	90°

$$2k + k = 90^{\circ}$$

$$3k = 90^{\circ}$$

$$\frac{3k}{3} = \frac{90^{\circ}}{3}$$

$$\underline{K = 30^{\circ}}$$

- v. Find the complement of ;

(a) 30°

(b) 63°

(c) $m - 15^{\circ}$

(d) p°

- vi. What angle is 5 times its complement

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is the
key

SUB TOPIC: Supplementary angles

Supplementary angles are two angles that add up to 180° .

Examples:

$$X + Y = 180^\circ \text{ (supp. angles)}$$

1. In the above figure, if $x = 48^\circ$, find y .

$$x + y = 180^\circ$$

$$y + 48^\circ = 180^\circ$$

$$y + 48^\circ - 48^\circ = 180^\circ - 48^\circ$$

$$\underline{y = 132^\circ}$$

2. What angle is $\frac{1}{4}$ of its supplement?

Let the angle be m

ANGLE	SUPPL.	TL
K	$4k$	180°

$$4k + k = 180^\circ$$

$$5k = 180^\circ$$

$$\frac{5k}{5} = \frac{180^\circ}{5}$$

$$\underline{\underline{K = 36^\circ}}$$

3. Find the supplement of;

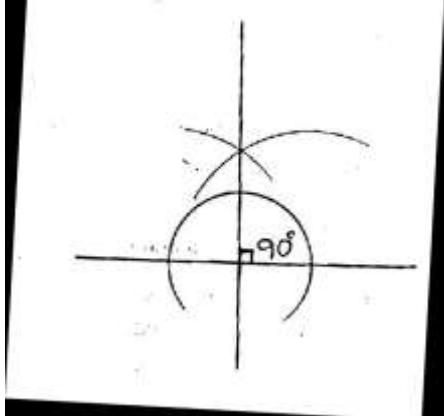
- 135°
- 15°
- 152°
- $2k - 20^\circ$

4. What angle is 5 times its supplement?

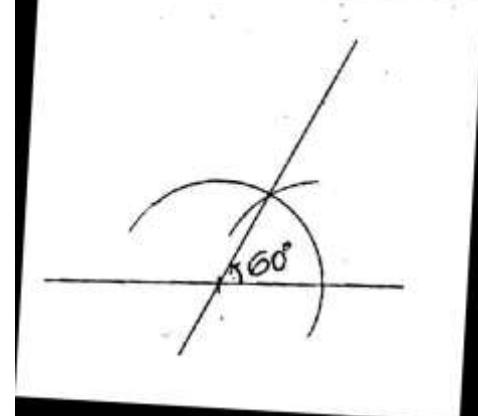
CONSTRUCTION

SUB TOPIC: Constructing special angles

1. Construct an angle of 90°



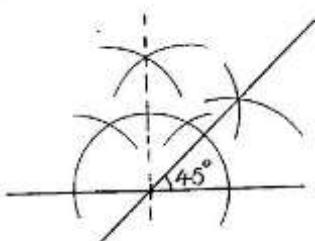
2. Construct an angle of 60°



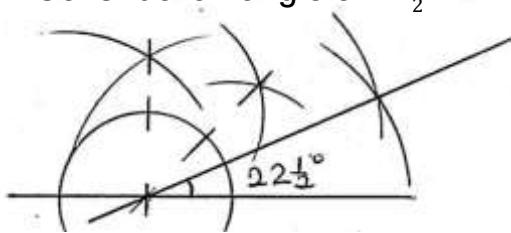
Mathematics
is the
key

SUB TOPIC: Constructing other angles

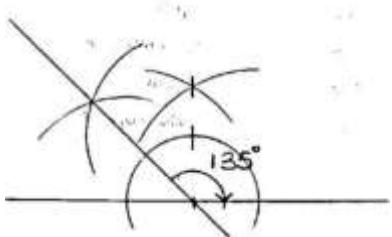
1. Construct an angle of 45°



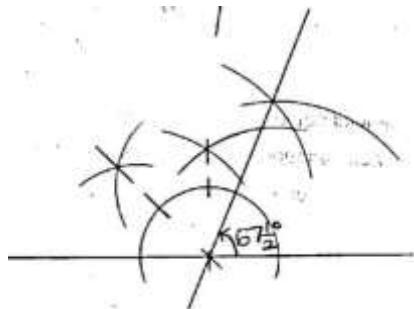
2. Construct an angle of $22\frac{1}{2}^\circ$



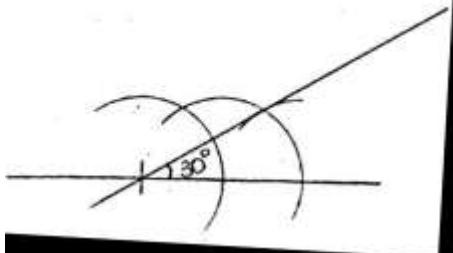
3. Construct an angle of 135°



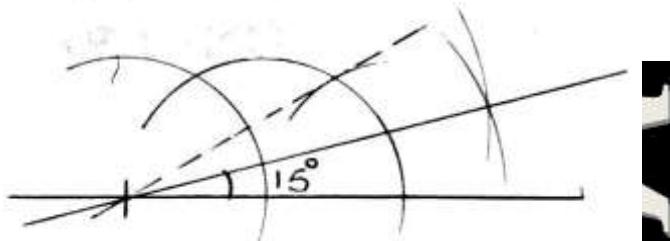
4. Construct an angle of $67\frac{1}{2}^\circ$



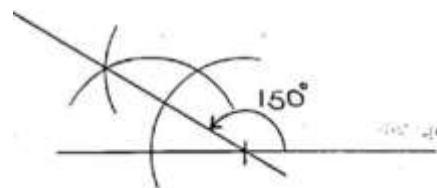
5. Construct an angle of 135°



6. Construct an angle of 15°



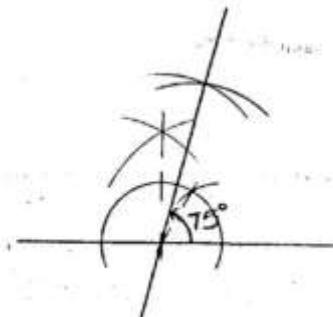
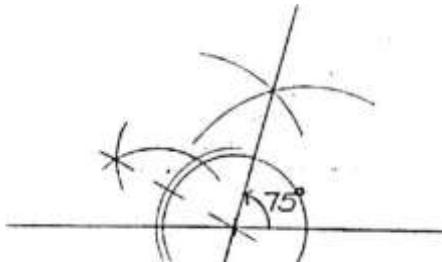
7. Construct an angle of 150°



8. Construct an angle of 165°

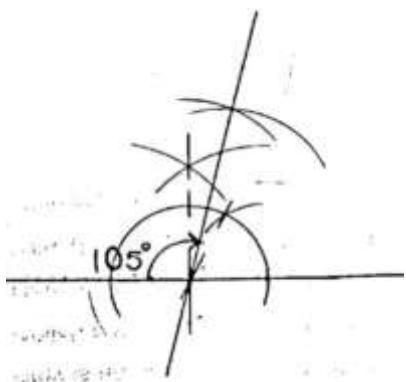


9. Construct an angle of 75°



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key

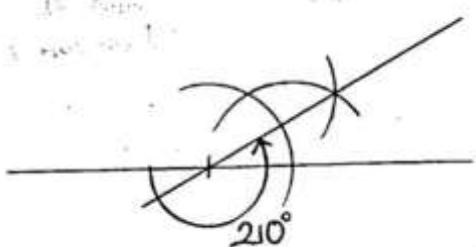
10. Construct an angle of 105°



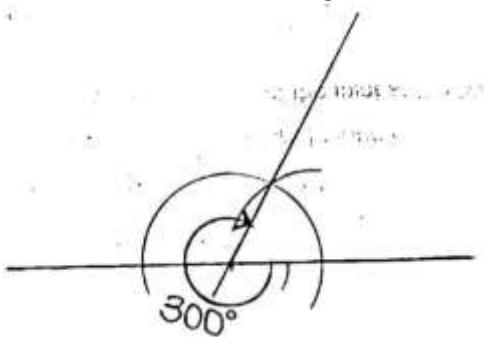
SUB TOPIC: Constructing reflex angles

A reflex angle is constructed by adding 180° to other angles

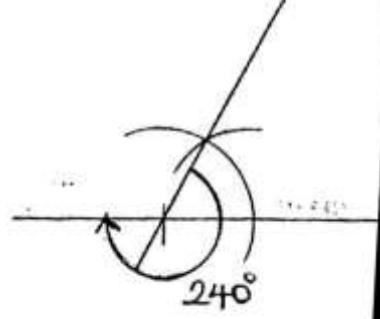
1. Construct an angle of 210°



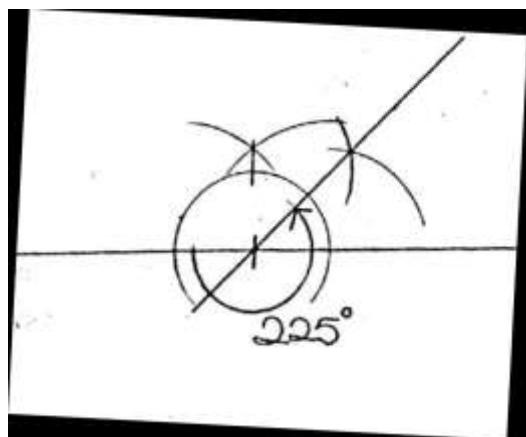
2. Construct an angle of 300°



3. Construct an angle of 240°

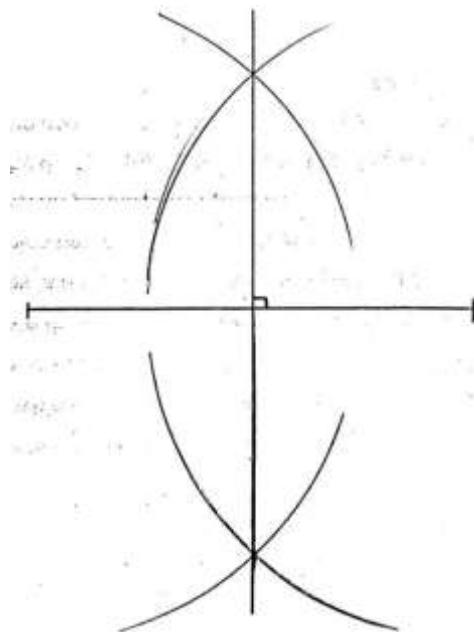


4. Construct an angle of 225°



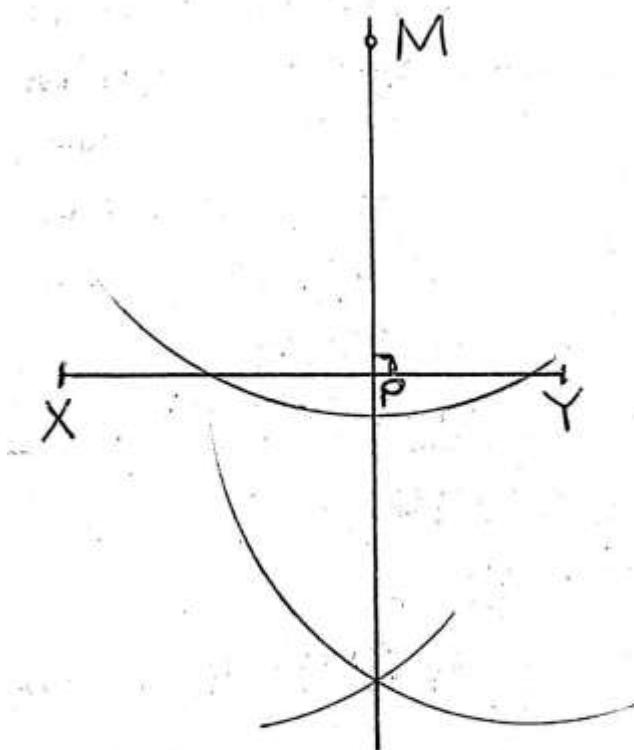
SUB TOPIC: Constructing perpendicular bisectors

1. Bisect the line below



SUB TOPIC: Constructing perpendicular from a point

1. Using a ruler, a pencil and a pair of compasses, drop a perpendicular from M to the line XY at p.



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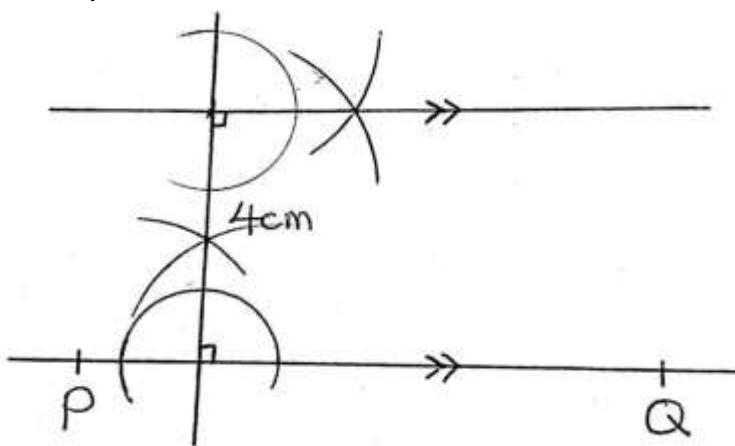
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SUB TOPIC: Constructing parallel lines

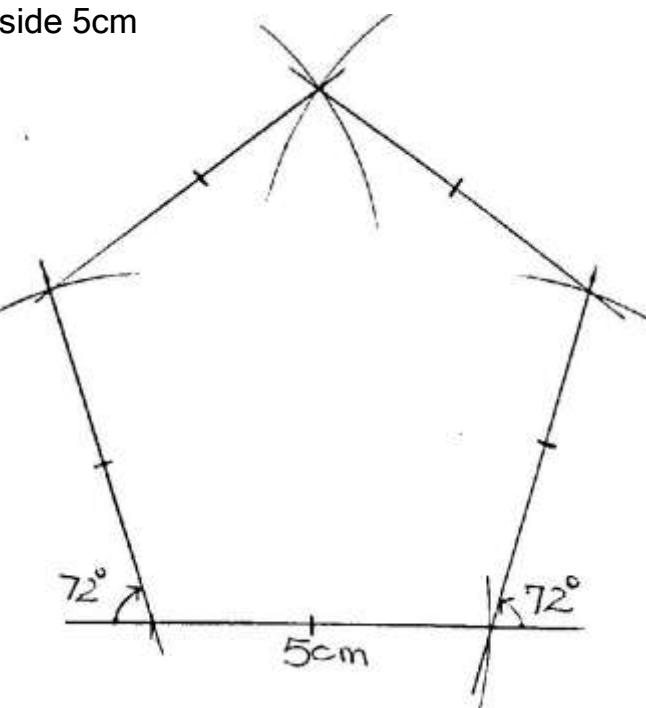
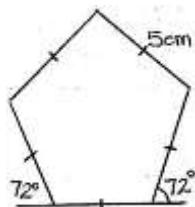
1. Construct a line parallel to line PQ below such that the lines are 4 cm apart.



SUB TOPIC: Constructing a pentagon when given a side

1. Construct a pentagon of side 5cm

$$\text{Ext. angle} = \frac{360^\circ}{5} \\ = 72^\circ$$

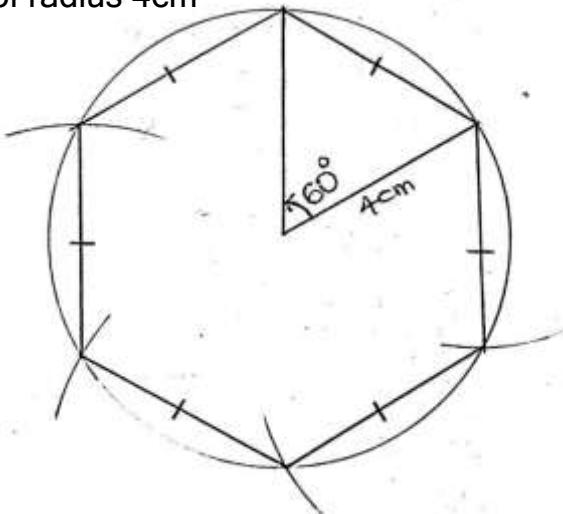


Mathematics is the Key

SUB TOPIC: Constructing polygons using a centre angle

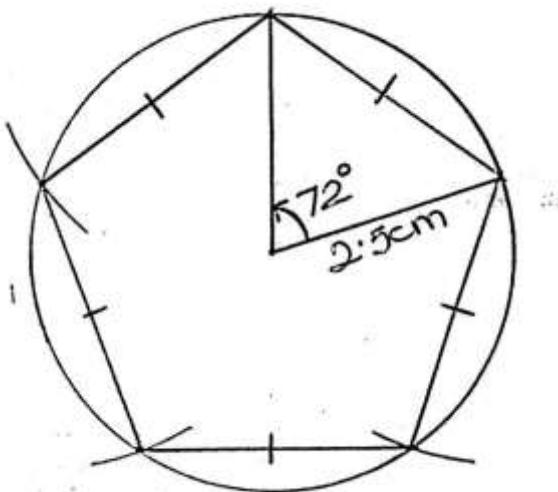
1. Construct a hexagon in a circle of radius 4cm

$$\text{Centre angle} = \frac{360^\circ}{6} \\ \equiv 60^\circ$$



2. Construct a pentagon in a circle of radius 2.5cm

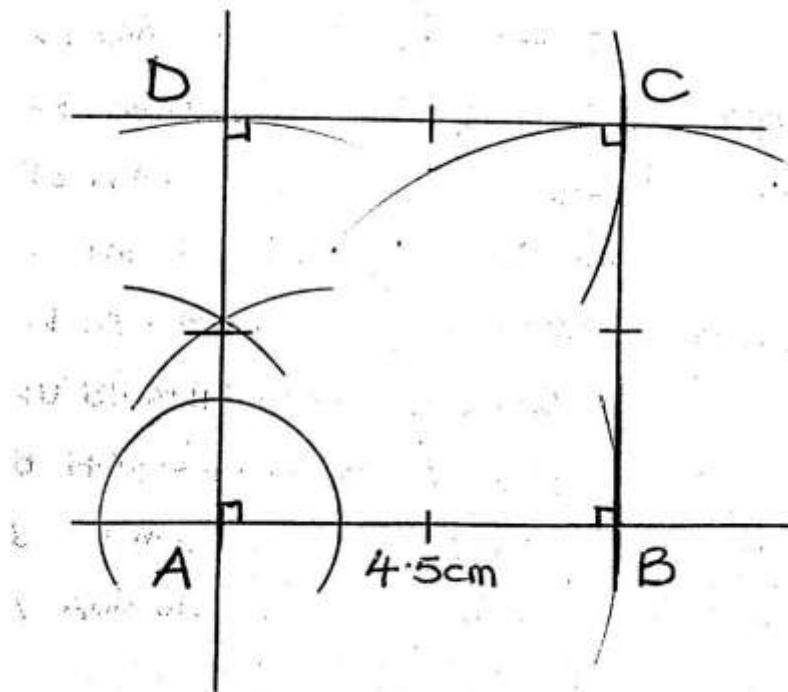
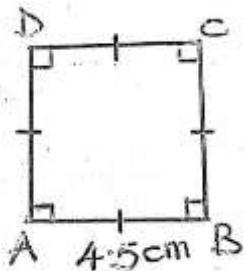
$$\text{Centre angle} = \frac{360^\circ}{5} \\ \equiv 72^\circ$$



Mathematics is the Key

SUB TOPIC: Constructing a square when given side

1. Construct square ABCD of side 4.5cm

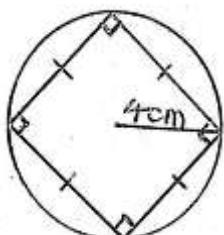


2. Construct a square of side 5.3 cm

3. Construct square MNOP where $MN=4\text{cm}$

SUB TOPIC: Constructing a square in a circle

1. Construct a square in a circle of radius 4cm



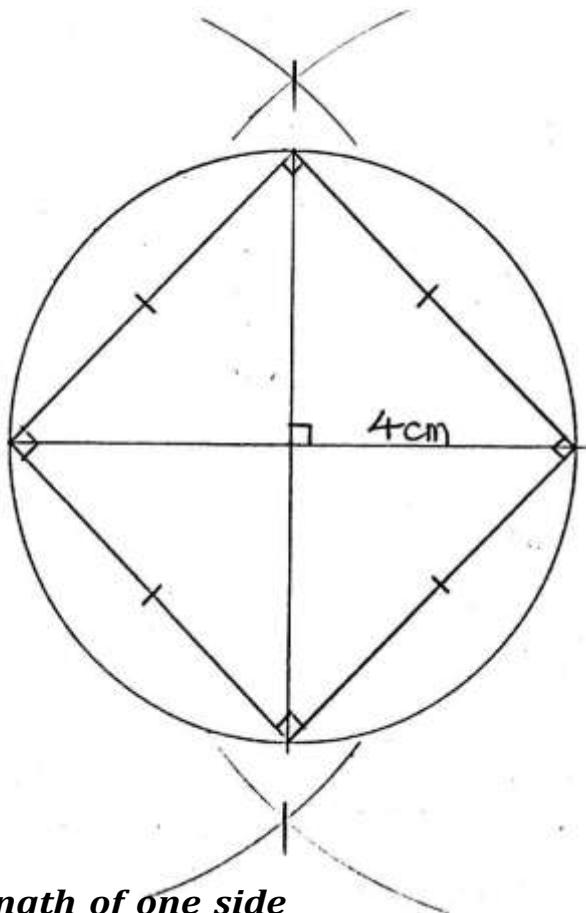
Mathematics is the Key

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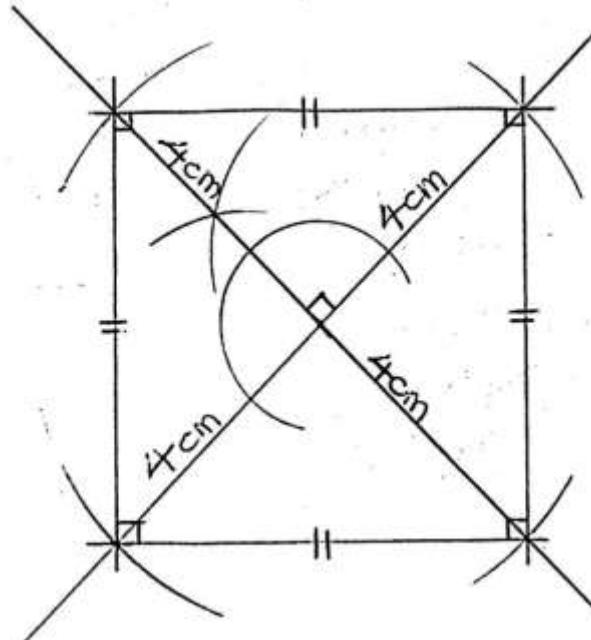
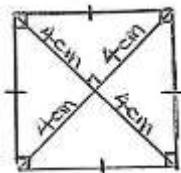


▲ Measure the length of one side

2. Construct a square in a circle of radius 6cm
3. Construct a square in a circle of radius 3.5cm

SUB TOPIC: Constructing a square using diagonals

1. Construct a square whose diagonal is 8cm

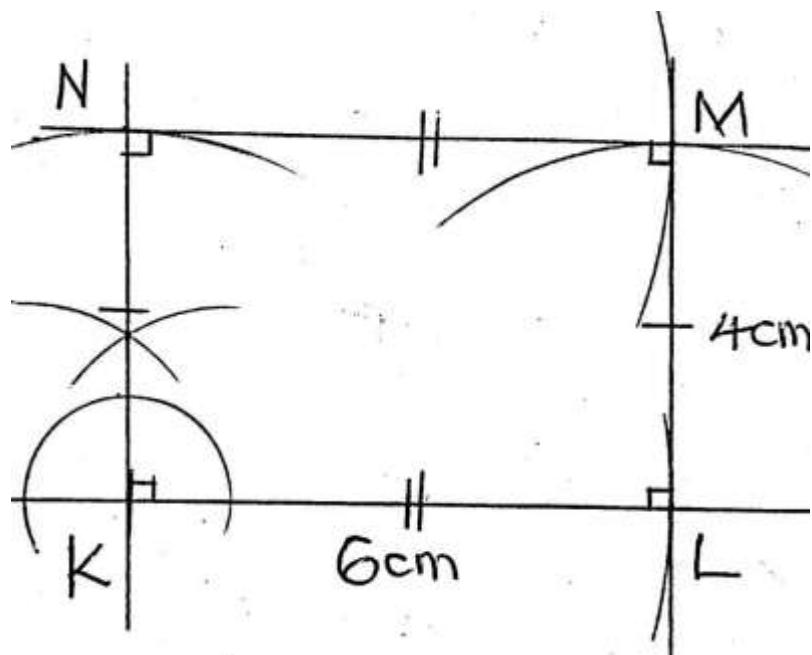
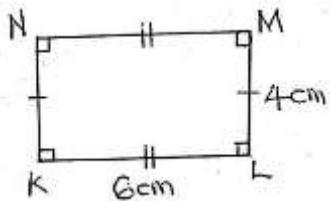


▲ Measure the length of one side

2. Construct a square whose diagonal is 9cm
3. Construct square PQRS whose diagonal is 8cm

SUB TOPIC: Constructing a rectangle when given sides

1. Construct rectangle KLMN where $KL=6\text{cm}$ and $LM = 4\text{cm}$.



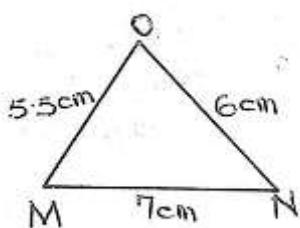
▲ Measure diagonal KM

▲ Measure angle MKL

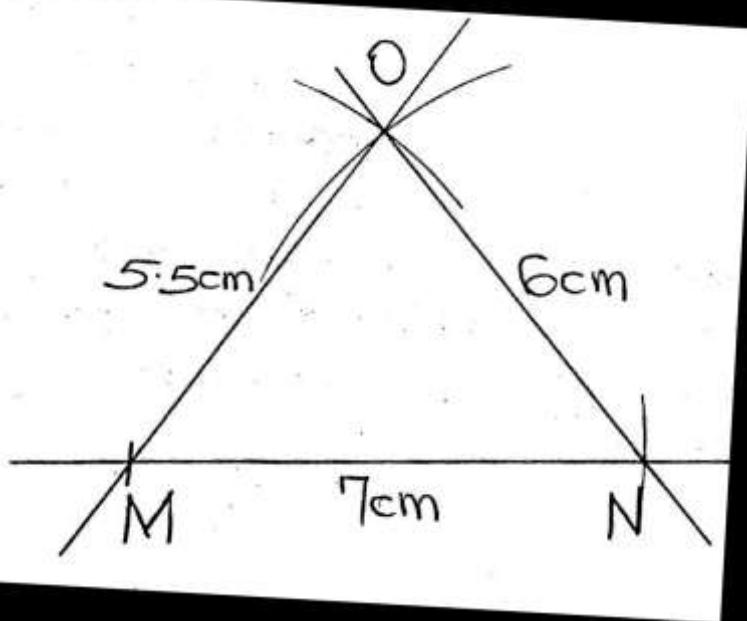
2. Construct a rectangle whose length is 7cm and width is 4.3cm.

SUB TOPIC: Constructing a triangle when given sides(SSS)

1. Construct triangle MNO where $MN= 7\text{cm}$, $NO=6\text{cm}$ and $MO=5.5\text{cm}$



Mathematics is the Key



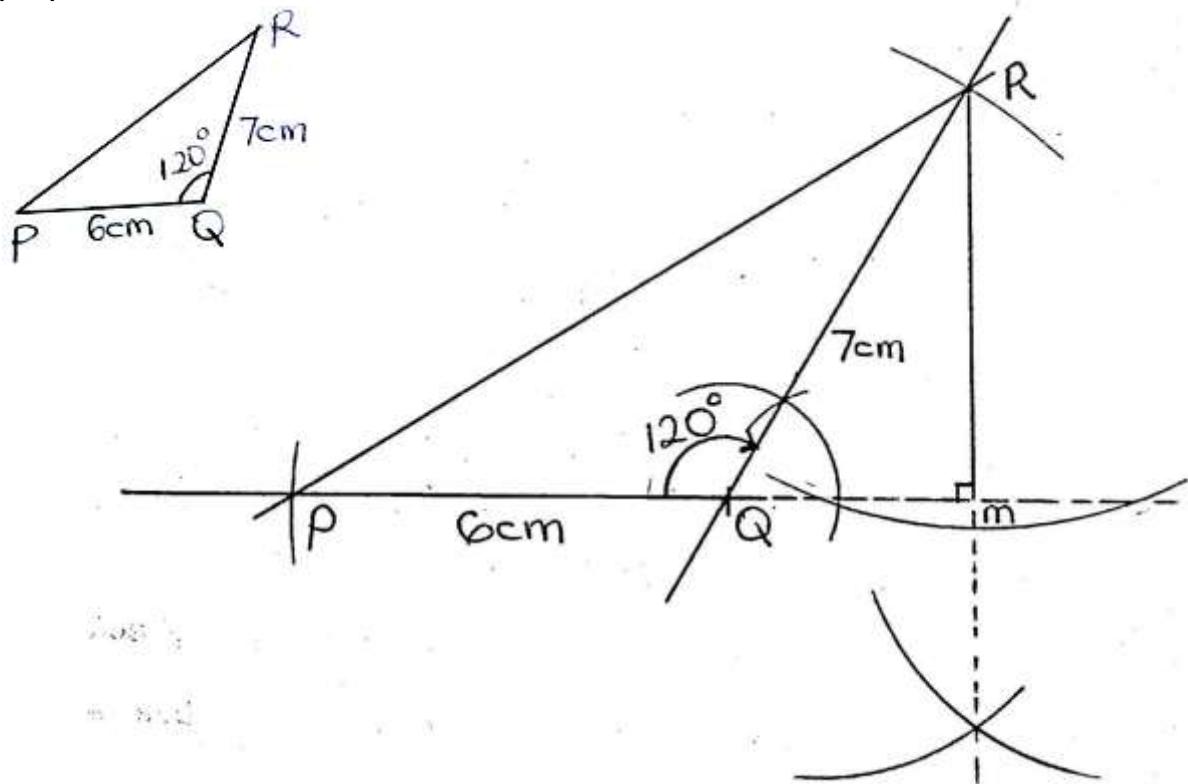
Mathematics is the key

◆ Measure angle OMN.

2. Construct triangle KLM in which $KL = 7.3\text{cm}$ $KM = LM = 8\text{cm}$

SUB TOPIC: Constructing a triangle when given two sides and one angle(SAS)

1. Construct triangle PQR where line PQ = 6cm, angle PQR = 120° and QR=7cm. Drop a perpendicular from R to meet PQ at m.

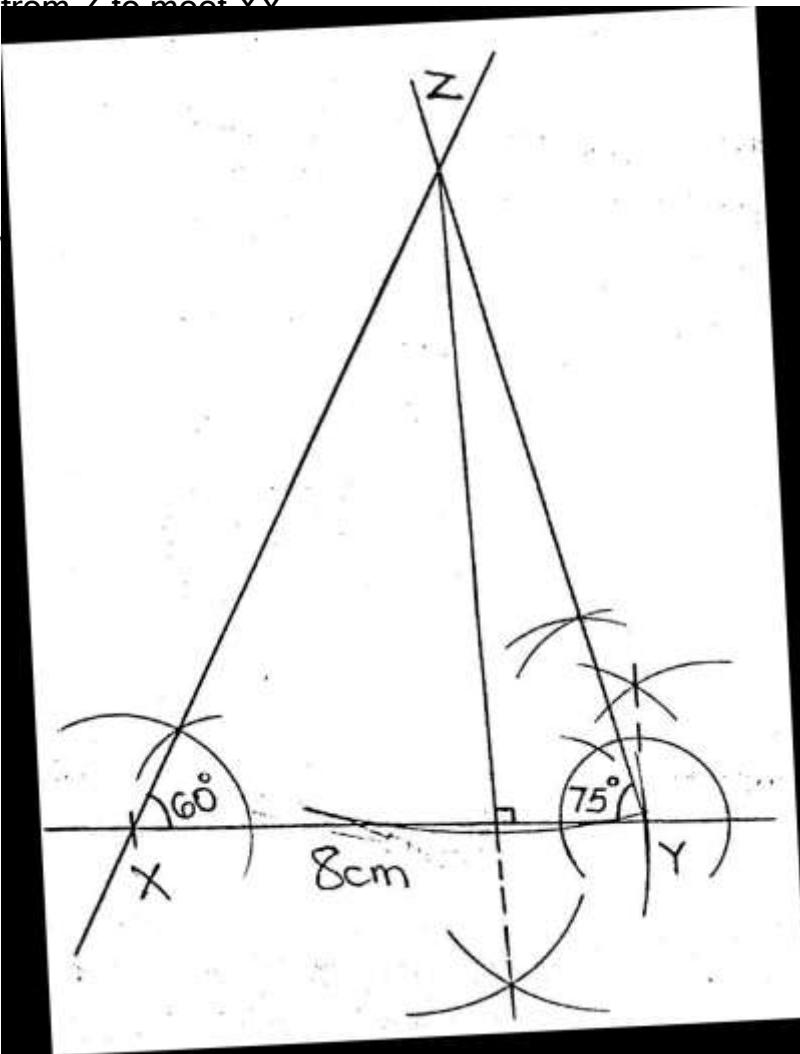
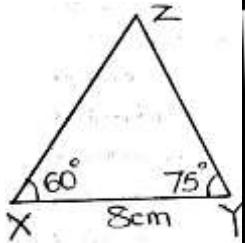


◆ Measure line RM

◆ Measure angle RPQ

SUB TOPIC: Constructing a triangle when given two angles and one side(ASA)

1. Construct triangle XYZ where XY=8cm, angle ZXY = 60° and angle XYZ= 75° .drop a perpendicular from Z to meet XY



♣ Measure line XZ

♣ Measure line YZ

♣ Measure the height of the triangle

♣ Find its area

2. Construct a triangle RST where angle R = 60° angle S = 45° and RS = 5cm Measure the length of ST and angle T.

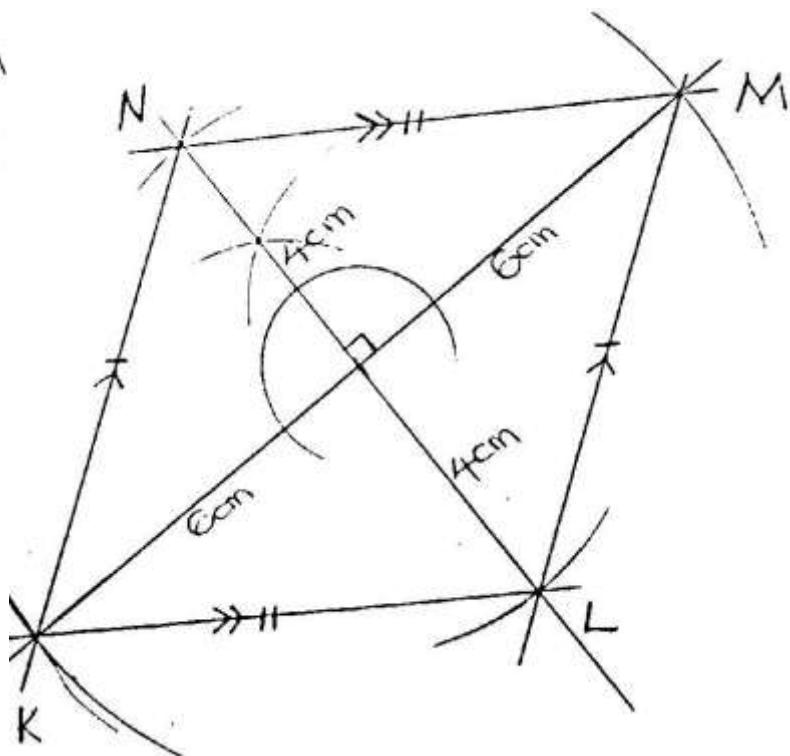
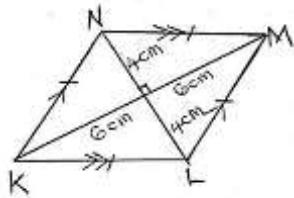
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SUB TOPIC: Constructing a rhombus when given diagonals

1. Construct rhombus KLMN where $KM=12\text{cm}$ and $LN=8\text{cm}$.



♠ *Measure line LM*

♠ Measure angle NKL

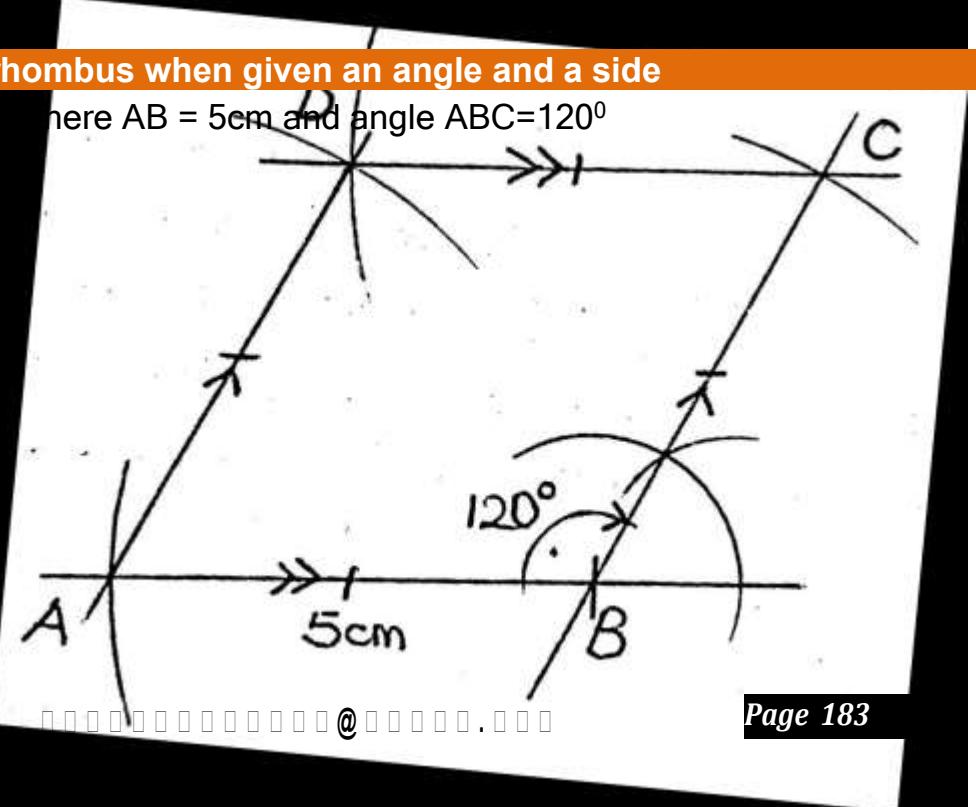
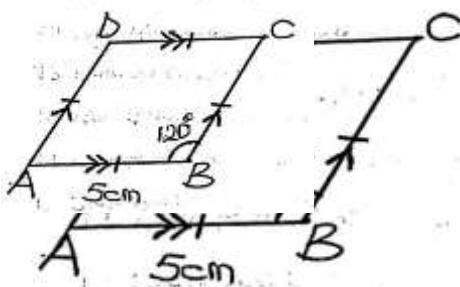
♠ Measure angle MKN

♠ Measure angle KNL

2. Construct a rhombus whose diagonals are 16cm and 12cm respectively.

SUB TOPIC: Constructing a rhombus when given an angle and a side

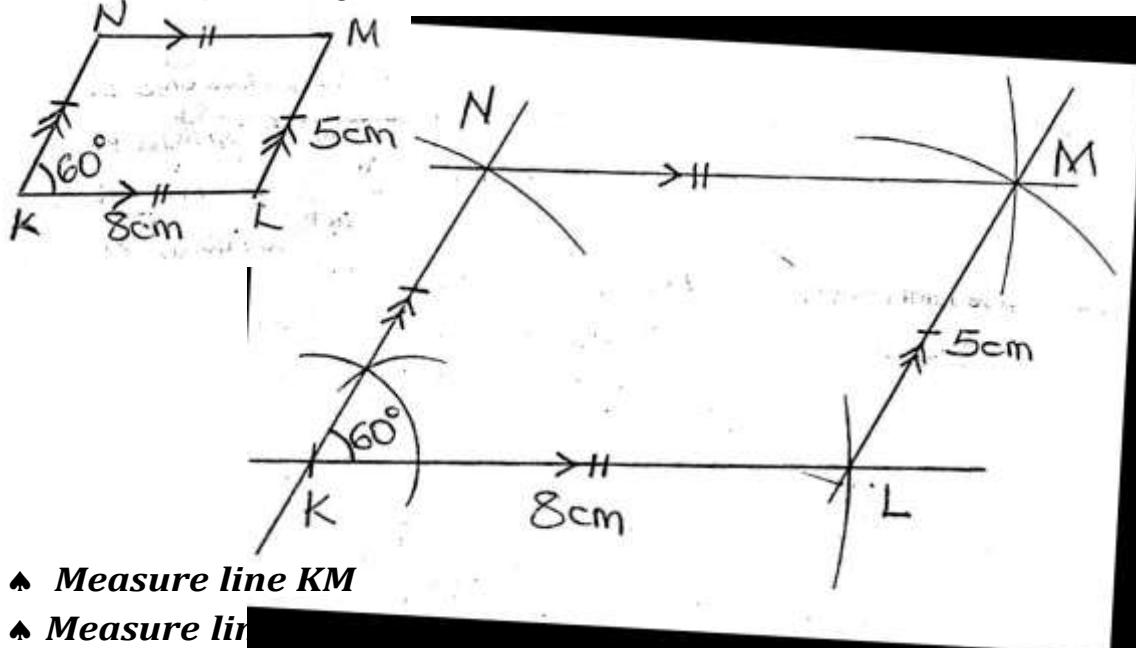
1. Construct rhombus ABCD where AB = 5cm and angle ABC=120°



- ♣ Measure line AC
- ♣ Measure line BD
- ♣ Measure angle DAB
- ♣ Measure angle CAB

SUB TOPIC: Constructing a parallelogram when given side and angle

1. Construct parallelogram KLMN where $KL=8\text{cm}$, $LM=5\text{cm}$ and $\angle LKN=60^\circ$



- ♣ Measure line KM
- ♣ Measure line [REDACTED]
- ♣ Measure angle MKL
- ♣ Measure angle KLM

BEARING AND SCALE DRAWING

SUB TOPIC: Rotations/Revolutions/Complete turns

This is the act of turning around a centre or an axis

$$1 \text{ complete turn} / 1 \text{ rotation} / 1 \text{ revolution} = 360^\circ$$

Examples

1. How many degrees are in two complete turns?

$$1 \text{ turn} = 360^\circ$$

$$\begin{aligned} 2 \text{ complete turns} &= 360^\circ \times 2 \\ &\equiv 720^\circ \end{aligned}$$

2. How many revolutions make up 1080° ?

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$$360^\circ = 1 \text{ revolution}$$

$$1080^\circ$$

$$1080^\circ = \frac{1080}{360}$$

$$= \frac{108}{36}$$

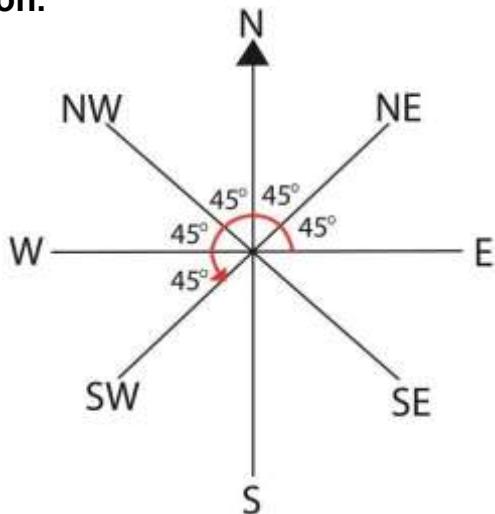
$$= 3 \text{ revolutions}$$

3. How many degrees are in $\frac{1}{2}$ turn?

4. A boy made 4 complete turns. Through what angle did he turn?

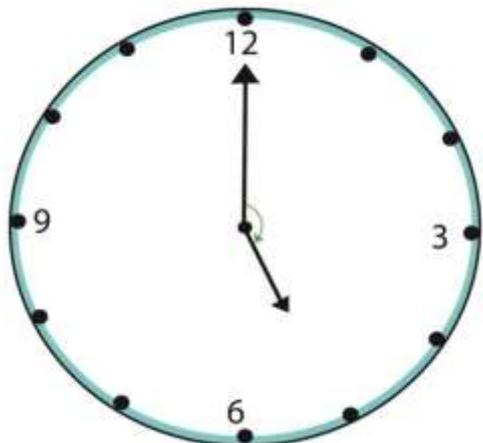
SUB TOPIC: Angles on a compass and a clock face

1. Kakuro was facing in East and turned anticlockwise through an angle of 225° . Find his new direction.



His new direction became South West

2. Calculate the smaller angle between the hands on the clock face below.



$$\frac{25}{60} \times 360^\circ$$

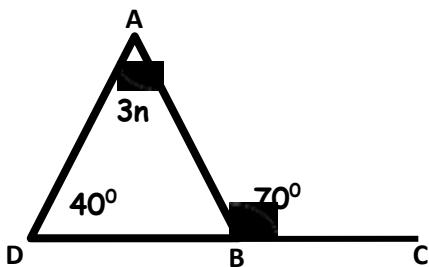
$$25 \times 6^\circ$$

$$\underline{150^\circ}$$

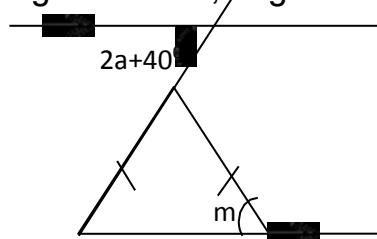
3. What angle can one turn after turning from South East to North in a clock wise direction?
4. What smaller angle is between West and North East?
5. Find the smaller angle between the North West and South West

TOPICAL REVISION QUESTIONS:

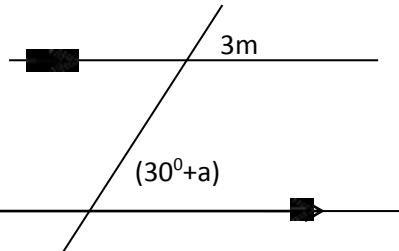
1. With the help of a ruler and pair of compasses only, construct the following angle
 - 30°
 - 45°
 - 75°
 - 120°
2. Construct using a ruler and pair of compasses only the triangles with the following measurement.
 - Triangle ABC where AB = 7cm, AC = 6cm and BC = 5cm
 - Triangle PQR where PQ = 8cm, $\angle Q = 120^\circ$ and QR = 5cm. Measure PR
3. What is the smaller angle between West and South West.
4. Construct a square WXYZ whose sides are 4.5cm.
5. Each interior angle of a regular polygon is 120° .
 - Find the number of sides of the polygon.
 - Calculate its interior angle sum.
6. How many degrees will Munduni turn through in $3 \frac{1}{4}$ revolutions?
7. In the triangle ABC below, find the value of n



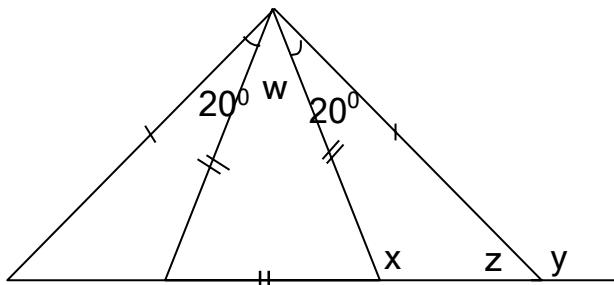
8. The supplement of $(a+30)^\circ$ is 40° , find the value of a
9. From the diagram below, angle $m = 3a$. Find the value of a



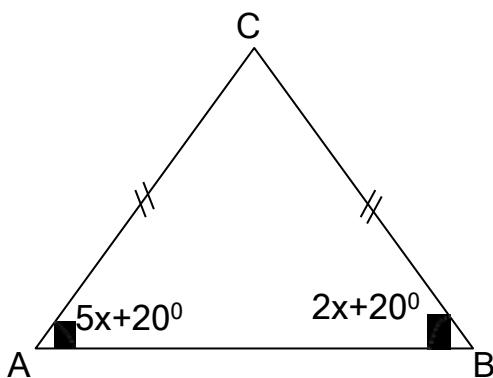
10. Given that $m = 2a$, find the value of a in degrees.



11. Calculate the size of angle w , x , y , z



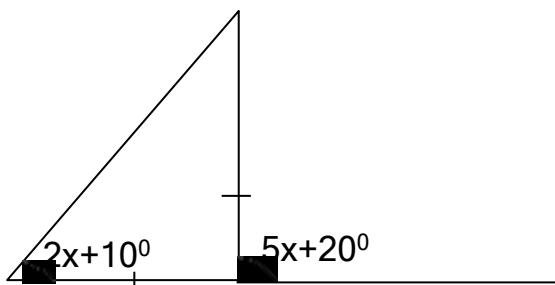
12. Use the figure below to answer the question the questions that follow.



(a) Find the value of x

(b) Find the size of angle ACB

13. find the value of x in degrees



ALGEBRA

SUB TOPIC: algebraic phrases and expressions

PHRASE	EXPRESSION
Sum of p and q	$p + q$
Multiply h by six	$6 \times h = 6h$
Add five to b	$b + 5$
Subtract p from x	$x - p$
Divide y by five	$\frac{y}{5}$
Two more than p	$p + 2$
P more than three	$3 + p$
Five less than k	$k - 5$
K less than six	$6 - k$
Double p	$p + p = 2p$
Triple f	$f + f + f = 3f$
Twice d	$2 \times d = 2d$
Three times w	$w \times 3 = 3w$
Two years younger than h	$(h - 2) \text{years}$
Five years older than k	$(k + 2) \text{years}$
Double m and add 9 to the result	$2m + 9$
Square of n	$n \times n = n^2$
Square root of m	$\sqrt[2]{m}$

SUB TOPIC: SUBSTITUTION

1. If $a = 5, b = 4$ and $c = 0$

Find the value of $a + b + c$

$$5 + 4 + 0$$

$$9 + 0$$

$$9$$

1. Given that $x = 2$ and $y = -2$

Evaluate $x - y$

$$(x) - (y)$$

$$2 - (-2)$$

$$2 + 2$$

$$4$$

2. Given $a = \frac{3}{4} b =$

$\frac{1}{3} \cdot \text{Find the value of } a + b$

$$(a) + (b)$$

$$\frac{3}{4} + \frac{1}{3}$$

$$\frac{9}{12} + \frac{4}{12}$$

$$\frac{13}{12}$$

$$\frac{1}{12}$$

$$1\frac{1}{12}$$

3. 4. If $y = 2$,

(a). what is the value of $3y^2$?

$$3y^2 = 3 \times y \times y$$

$$= 3 \times 2 \times 2$$

$$= 3 \times 4$$

$$= 12$$

(b) what is the value of $(3y)^2$?

$$(3y)^2 = 3y \times 3y$$

$$= 3 \times 2 \times 3 \times 2$$

$$= 6 \times 6$$

$$= 36$$

4. Given that $a = 3, b = 4$ and $c = 5$

(a). What is $3a \times 3b$

(b) What is $c(b - a)$

5. If $m = 2$, what is the value of m^2 ?

6. If $a = \frac{1}{2}, c = \frac{2}{3}$ and $d = \frac{1}{4}$. Evaluate $ac + d$

7. If $m = 4, n = 3$ and $p = 2$, what is $\frac{n^3 \times m^2}{mp}$

Mathematics

is the

key

SUB TOPIC: Collecting and simplifying like terms

Examples:

1. $a + a + a = 3a$
2. $2p + 3p + p = 6p$
3. $2ab + ab + 5ab = 8ab$
4. $x + y + x + y + x$
 $x + x + x + y + \cancel{y}$
 $\underline{+ 2y}$
5. $3p - 6f - p + 2f$
 $3p - p + 2f - 6f$
 $\underline{2p - 4f}$
 Simplify the following
 - (a) $2m + m + 4m$
 - (b) $6k + 4p - 3k - p$
 - (c) $2xy - y + 5xy - y$

SUB TOPIC: Addition and subtraction

1. Simplify the following

$$(a) \frac{2m}{3} + \frac{m}{2}$$

$$\frac{2m}{3} \times \frac{2}{2} + \frac{m}{2} \times \frac{3}{2}$$

$$\frac{4m}{6} + \frac{3m}{6}$$

$$\frac{4m + 3m}{6}$$

$$\frac{7m}{6}$$

$$1\frac{1m}{6}$$

$$(b) p - \frac{p}{3}$$

$$\frac{p}{1} - \frac{p}{3}$$

$$\frac{p}{1} \times 3 - \frac{p}{3} \times 3$$

$$\frac{3p - p}{3}$$

$$\frac{2p}{3}$$

2. Simplify the following

$$(a) \frac{3d}{4} + d + \frac{d}{2}$$

$$(b) \frac{3r}{7} - \frac{2r}{6} + \frac{r}{4}$$

SUB TOPIC: multiplication and division

1. Simplify the following.

$$(a) \frac{\frac{3k}{7} \times \frac{1}{6}}{\frac{3k}{7} \times \frac{1}{6}}$$

$$\frac{3k}{42}$$

$$\frac{k}{14}$$

$$(b) \frac{\frac{4m}{11} \div \frac{m}{15}}{\frac{4m}{11} \div \frac{m}{15}}$$

$$\frac{4m}{11} \times \frac{15}{m}$$

$$\frac{60}{11}$$

$$5\frac{5}{11}$$

$$(c) \frac{6x}{9} \times \frac{1}{2} \div \frac{x}{4}$$

$$(d) \frac{3b}{13} \times \frac{8}{5}$$

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SUB TOPIC: Removing brackets

REMEMBER:

- When removing brackets, multiply the factor by every term inside brackets.
- A negative integer before brackets affects every sign inside brackets.
- A positive integer before brackets cannot affect the signs inside brackets.

Remove the brackets and simplify.

Example:

1. $3(x + y)$
 $3(x + y)$
 $3x + 3y$

2. $2(a - b)$
 $2(a - b)$
 $2a - 2b$

3. $4(2x - 6)$
4. $-9(m - 4)$

5. Add: $x + 4$ to $x + 1$
 $(x + 4) + (x + 1)$
 $X + 4 + x + 1$
 $X + x + 4 + 1$
 $2x + 5$

6. Subtract $y - 1$ from $2y + 3$
 $(2y + 3) - (y - 1)$
 $2y + 3 - y + 1$
 $2y - y + 3 + 1$
 $y + 4$

7. Add $x - 4$ to $3x - 5$
8. Subtract $3p - 1$ from $5p - 3$
9. Find the supplement of $(x - 20)$

SUB TOPIC: Removing brackets involving fractions

Example:

Remove brackets and simplify

1. $\frac{1}{3}(3a + 9b)$
 $\frac{1}{3} (3a + 9b)$
 $(\frac{1}{3} \times 3a) + (\frac{1}{3} \times 9b)$
 $a + 3b$

2. $\frac{3}{4}(8m - 12p)$
 $\frac{3}{4} \times 8m - \frac{3}{4} \times 12p$
 $3 \times 2m - 3 \times 3p$
 $6m - 9p$

3. Half of $(2x + 4y)$ plus a third of $(6x + 9y)$
 $\frac{1}{2} (2x + 4y) + \frac{1}{3} (6x + 9y)$
 $\frac{1}{2} \times 2x + \frac{1}{2} \times 4y + \frac{1}{3} \times 6x$
 $\times 9y$
 $x + 2y + 2x + 3y$
 $x + 2x + 2y + 3y$
 $3x + 5y$

Mathematics

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key

4. Subtract $\frac{1}{2}(4x - 2y)$ from $\frac{1}{3}(6x - 9y)$

$$\frac{1}{3}(6x - 9y) - \frac{1}{2}(4x - 2y)$$
$$\frac{1}{3}x 6x - \frac{1}{3}x 9y - \frac{1}{2}x 4x + \frac{1}{2}x 2y$$

$$2x - 3y - 2x + y$$

$$2x - 2x - 3y + y$$

$$\underline{-2y}$$

5. Subtract $\frac{2}{3}(6x - 3y)$ from $\frac{1}{4}(8x - 12y)$

6. Remove brackets and simplify. $\frac{2}{5}(5x + 15y) -$

$$\frac{1}{6}(12x - 24y)$$

SUB TOPIC: POWERS or INDICES (Addition and subtraction with powers)

Example:

Simplify the following

1. $2^2 + 2^4$

$$(2 \times 2) + (2 \times 2 \times 2 \times 2)$$

$$2x2 + 2x2x2x2$$

$$\underline{20}$$

2. $p^2 + p^2$

$$p^2 + p^2$$

$$\underline{2p^2}$$

3. $3m^3 + 4m^3$

$$3m^3 + 4m^3$$

$$\underline{7m^3}$$

4. $3p^2 - 2p^3$

$3p^2 - 2p^3$ (they are unlike terms)

5. $4m^2 - m^2$

6. $20k^4 + 17k^4$

7. $b^5 - b^3$

SUB TOPIC: POWERS or INDICES (multiplication of powers with similar bases)

NOTE:

When multiplying powers with similar bases, write a single base and add the powers.

Example:
Simplify the following

a) $4^3 \times 4^2$

$$4 \times 4 \times 4 \times 4 \times 4$$

$$4^5$$

OR

$$4^3 \times 4^2$$

$$4^{3+2}$$

$$4^5$$

b) $x^3 \times x^2$

$$x \times x \times x \times x \times x$$

$$x^5$$

OR

$$x^3 \times x^2$$

$$x^{3+2}$$

$$x^5$$

Simplify the following

(a) $m^2 \times m \times m^4$

(b) $3^2 \times 3^5$

(c) $b^7 \times b^6$

Mathematics is the key

SUB TOPIC: POWERS or INDICES**(Division of powers with similar bases)**

NOTE:

When dividing powers with similar bases, write a single base and subtract the powers.

Example:

Simplify the following.

1. $3^4 \div 3^2$

$$\frac{3 \times 3 \times 3 \times 3}{3 \times 3} \\ 3^2$$

OR

$3^4 \div 3^2$

$$\underline{3^4-2} \\ 3^2$$

2. $p^{8 \div 2}$

$$\frac{p \times p \times p \times p \times p \times p \times p \times p}{p \times p} \\ p \times p \times p \times p \times p \times p \times p \\ p^6$$

OR

$$\underline{p^{8 \div 2}} \\ p^{8-2} \\ p^6$$

3. $n^7 \div n^9$

$$\frac{n \times n \times n \times n \times n \times n \times n}{n \times n \times n} \\ \frac{1}{n \times n} \\ \frac{1}{n^2}$$

n^{-2}

OR

$n^7 \div n^9$

n^{7-9}

n^{-2}

4. Simplify the following

(a). $m^2 \div m$

(b). $3^2 \div 3^5$

(c). $b^3 \div b^6$

SUB TOPIC: POWERS or INDICES**(Multiplication and Division of powers with similar bases)****1. Simplify the following.**

i. $\frac{k^4 \times k^3}{k^5}$

$(k^4 \times k^3) \div k^5$

$(k^{4+3}) \div k^5$

$k^7 \div k^5$

k^{7-5}

k^2

ii. $\frac{w^3 \times w^0 \times w^6}{w^{10}}$

iii. $\frac{p^{5 \times p^3}}{p^4}$

Mathematics is the key

SUB TOPIC: POWERS or INDICES

(Solving for unknown powers)

1. Solve for the unknowns

(a) $2^x = 8$

$2^x = 8$

$2^x = 2^3$

$\underline{x = 3}$

2	8
2	4
2	2
	1

$8 = 2^3$

(b) $3^m \times 3^2 = 81$

$3^m \times 3^2 = 81$

$3^{m+2} = 3^4$

$m + 2 = 4$

$m + 2 - 2 = 4 - 2$

$\underline{m = 2}$

3	81
3	27
3	9
3	3
	1

$81 = 3^4$

(c) $4^{2x} \div 16 = 64$

$4^{2x} \div 16 = 64$

$4^{2x} \div 4^2 = 4^3$

$4^{2x-2} = 4^3$

$2x - 2 = 3$

$2x - 2 + 2 = 3 + 2$

$2x = 5$

$2x = 5$

$\frac{2}{2} = \frac{5}{2}$

$x = 2\frac{1}{2}$

4	64
4	16
4	4
	1

$64 = 4^3$

(d) $5^k = 125$

(e) $2^{m+4} \times 8 = 1$

SUB TOPIC: Solving simple equations.

Example: Solve the following equations

a) $x + 5 = 13$

$x + 5 - 5 = 13 - 5$

$\underline{x = 8}$

b) $2x + 6 = 18$

$2x + 6 - 6 = 18 - 6$

$2x = 12$

$\frac{2x}{2} = \frac{12}{2}$

$x = 6$

c) $y - 3 = 5$

$y - 3 + 3 = 5 + 3$

$\underline{y = 8}$

d) $3a - 8 = 7$

$3a - 8 + 8 = 7 + 8$

$3a = 15$

$\frac{3a}{3} = \frac{15}{3}$

$\underline{a = 5}$

e) $6m = 24$

f) $5k - 3 = 37$

g) $4 - x = 7$

h) $16 = 9 + 2p$

Type equation here.

SUB TOPIC: Solving equations involving brackets.

Solve the following equations

a) $2(m + 4) = 20$

$2(m + 4) = 20$

$2m - 8 = 20$

$2m - 8 + 8 = 20 + 8$

$2m = 28$

$\frac{2m}{2} = \frac{28}{2}$

$\underline{m = 14}$

b) $2(k - 2) - 3(k - 4) = -10$

$2(k - 2) - 3(k - 4) = -10$

$2k - 4 - 3k + 12 = -10$

$2k - 3k - 4 + 12 = -10$

$-k + 8 = -10$

$-k + 8 - 8 = -10 - 8$

$-k = -18$

$\frac{-k}{-1} = \frac{-18}{-1}$

$\underline{k = 18}$

c) $6(z - 4) = 0$

d) $3x - (2 - x) = 14$

e) $5(m - 2) + 6(m - 3) = 16$

Mathematics is the key

SUB TOPIC: Solving equations involving fractions

When solving fractional equations, multiply the LCD (LCM of the denominators) on each algebraic term.

Solve the following equations

$$1. \frac{1}{2}p = 6$$

$$\frac{1}{2}p = 6$$

$$LCD = 2$$

$$2 \times \frac{p}{2} = 6 \times 2$$

$$p = 12$$

$$2. \frac{13t}{3} + 2 = 15$$

$$\frac{13t}{3} + \frac{2}{1} = \frac{15}{1}$$

$$LCD = 3$$

$$3 \times \frac{13t}{3} + \frac{2}{1} \times 3 = \frac{15}{1} \times 3$$

$$13t + 6 = 45$$

$$13t + 6 - 6 = 45 - 6$$

$$13t = 39$$

$$\frac{13t}{13} = \frac{39}{13}$$

$$t = 13$$

$$3. 0.4P + 0.5 = 2.1$$

$$\frac{4P}{10} + \frac{5}{10} = \frac{21}{10}$$

$$10 \times \frac{4P}{10} + \frac{5}{10} \times 10 = \frac{21}{10} \times 10$$

$$4P + 5 = 21$$

$$4P + 5 - 5 = 21 - 5$$

$$4P = 16$$

$$\frac{4P}{4} = \frac{16}{4}$$

$$\underline{P = 4}$$

$$4. 3x + 7 - \frac{3x}{4} = 10$$

$$\frac{3x}{1} + \frac{7}{1} - \frac{3x}{4} = \frac{10}{1}$$

$$LCD = 4$$

$$4 \times \frac{3x}{1} + \frac{7}{1} \times 4 - \frac{3x}{4} \times 4 = \frac{10}{1} \times 4$$

$$12x + 28 - 3x = 40$$

$$12x - 3x + 28 = 40$$

$$9x + 28 = 40$$

$$9x + 28 - 28 = 40 - 28$$

$$\frac{9x}{9} = \frac{12}{9}$$

$$x = 1\frac{1}{3}$$

$$5. \frac{3m}{4} = 9$$

$$6. \frac{2p}{3} - p = 5$$

$$7. \frac{2k}{5} + k = 12$$

$$8. 1.5y - 2.5 = 5.0$$

$$9. 2p - 5 - \frac{3p}{5} = 10$$

Mathematics

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key

SUB TOPIC: Solving more equations involving fractions.

Examples:

Solve the following equations

$$1. \frac{m+1}{3} + \frac{m}{4} = 2$$

$$\frac{m+1}{3} + \frac{m}{4} = 2$$

LCD = 12

$$12 \times \frac{m+1}{3} + \frac{m}{4} \times 12 = 2 \times 12$$

$$4(m+1) + m \times 3 = 2 \times 12$$

$$4m + 4 + 3m = 24$$

$$4m + 3m + 4 = 24$$

$$7m + 4 = 24$$

$$7m + 4 - 4 = 24 - 4$$

$$7m = 20$$

$$\frac{7m}{7} = \frac{20}{7}$$

$$m = 2\frac{6}{7}$$

$$2. \frac{(3x+1)}{4} = \frac{(x+2)}{2}$$

$$\frac{(3x+1)}{4} = \frac{(x+2)}{2}$$

$$\frac{LCD}{4} = \frac{4}{2}$$

$$4 \times \frac{(3x+1)}{4} = \frac{(x+2)}{2} \times 4$$

$$3x + 1 = 2(x + 2)$$

$$3x + 1 = 2x + 4$$

$$3x + 1 - 1 = 2x + 4 - 1$$

$$3x = 2x + 3$$

$$3x - 2x = 2x - 2x + 3$$

$$\underline{\underline{x = 3}}$$

$$3. \frac{3x-1}{4} = \frac{7x+1}{6}$$

$$4. \frac{w-5}{3} - w = \frac{2w+4}{5}$$

$$5. \frac{3}{k+3} = \frac{2}{2k-5}$$

SUB TOPIC: Solving equations involving squares and square roots

Examples:

Solve the following equations

$$1. m^2 - 4 = 21$$

$$m^2 - 4 + 4 = 21 + 4$$

$$m^2 = 25$$

$$\sqrt{m^2} = \sqrt{25}$$

$$\underline{\underline{m = 5}}$$

$$2. \frac{1}{2} p^2 = 8$$

$$\frac{1}{2} p^2 = 8$$

$$2 \times \frac{p^2}{2} = 8 \times 2$$

$$p^2 = 16$$

$$\sqrt{p^2} = \sqrt{16}$$

$$\underline{\underline{p = 4}}$$

$$3. \sqrt{2k} = 14$$

$$\sqrt{2k} = 14$$

$$\sqrt{2k}^2 = 14^2$$

$$2k = 196$$

$$\frac{2k}{2} = \frac{196}{2}$$

$$\underline{\underline{k = 98}}$$

$$4. \frac{1}{4} x^2 = 16$$

$$\frac{1}{4} x^2 = 16$$

$$4 \times \frac{x^2}{4} = 16 \times 4$$

$$x^2 = 64$$

$$\sqrt{x^2} = \sqrt[2]{64}$$

$$\underline{\underline{x = 8}}$$

$$5. b^2 = 49$$

$$6. 6m^2 = 54$$

$$7. 2w^2 - 18 = 224$$

$$8. \frac{2p^2}{3} = 54$$

Mathematics

SUB TOPIC: Forming and solving equations

Example:

- Baker bought 2kg of sugar at sh. 3p and 1kg of salt at sh (p + 200). Find P if Baker paid sh 3700.

The cost of 2kg of sugar is

$$sh (2 \times 3p) = sh 6p$$

The cost of 1kg of salt is

$$sh (p + 200)$$

$$Sh 6p + sh. p + shs. 200 = shs. 3700$$

$$Sh 7p + sh. 200 = sh. 3700$$

$$Sh 7p + sh. 200 - shs. 200 = sh. 3700 - sh. 200$$

$$Sh. 7p = sh. 3500$$

$$\frac{Sh. 7p}{sh. 7} = \frac{sh. 3500}{sh. 7}$$

$$\underline{\underline{p = 500}}$$

- In a market, the cost of a pawpaw is sh.800 more than the cost of a mango.

A mango costs two thirds the cost of a pine apple. The total cost of three fruits is sh 4300. Calculate the cost of a pineapple.

Let the cost of a pineapple be m

pawpaw	pineapple	mango
$\frac{2}{3}m + sh. 800$	m	$\frac{2}{3}m$



$$m + \frac{2}{3}m + \frac{2}{3}m + sh. 800 = sh. 4,300$$

$$\frac{m}{1} + \frac{2m}{3} + \frac{2m}{3} + \frac{sh. 800}{1} = \frac{sh. 4,300}{1}$$

$$\frac{m}{1} \times 3 + \frac{4m}{3} \times 3 + \frac{sh. 800}{1} \times 3 = \frac{sh. 4300}{1} \times 3$$

$$3m + 4m + sh. 2,400 = sh. 12,900$$

$$7m + sh. 2,400 = sh. 12,900$$

$$7m + sh. 2,400 - sh. 2,400 = sh. 12,900 - sh. 2,400$$

$$7m = sh. 10,500$$

$$\frac{7m}{7} = \frac{sh. 10,500}{7}$$

$$\underline{\underline{m = sh. 1,500}}$$

- A cup costs twice as much as a fork and a plate costs sh.600 more than a fork. If the total cost of all the three items is sh.3600, find the cost of each item.
- James, Joan and Peter shared a certain amount of money. James got three times as much as Peter. Joan got sh.900 more than Peter. If Peter and James got sh.2,800, how much did Joan get?

SUBTOPIC: Application of algebra in ages

Examples.

- Amon is twice as old as Bob. If their total age is 33 years. How old is each?

Let Bob's age be A

Amon	Bob	TL
2A	A	33years

$$2A + A = 33$$

$$3A = 33$$

$$\frac{3A}{3} = \frac{33}{3}$$

$$A = 11\text{years}$$

Amon	Bob
2A	A
$2 \times 11 = 22\text{yrs}$	11years

- A father is 18years older than his son. In 5 years ,their total age will be 48years. How old is each?

Let the son's age be m

	father	son	TL
now	$m + 18$	m	
then	$m + 18 + 5$	$m + 5$	48years

$$m + 18 + 5 + m + 5 = 48\text{years}$$

$$m + m + 18 + 10 = 48\text{years}$$

$$2m + 28 = 48\text{years}$$

$$2m + 28 - 28 = 48 - 28$$

$$2m = 20$$

$$\frac{2m}{2} = \frac{20}{2}$$

$$m = 10\text{years}$$

father	son
$m + 18$	10years
$10 + 18 = 28\text{yrs}$	

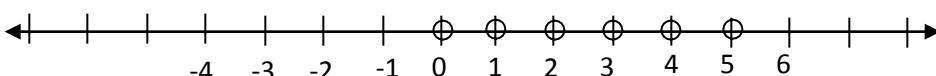
3. Alex is 15 years older than Moses. If their total age is 40 years, how old is each?
4. Jacob is 10 years younger than Jerome. Six years ago, Jerome was twice as old as Jacob. How old is Jacob?
5. A son is a half of his mother's age while the daughter is a third of his mother's age. If the total age of the son and the daughter is 30 years, how old is the mother?
6. January is a third as old as March. Four years ago the ratio of their age was 1:5. How old is each now?

SUB TOPIC: Writing solution sets

Examples:

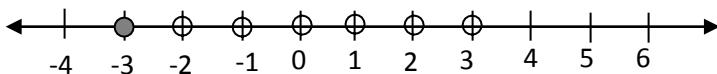
1. Write down the integers for the following inequalities.

(i) $x < 6$



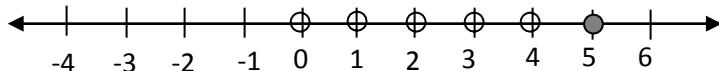
$x = \{5, 4, 3, 2, 1, 0, -1, \dots\}$ (infinite set)

(ii) $m \geq -3$



$m = \{-3, -2, -1, 0, 1, 2, \dots\}$ (infinite set)

(iii) $k \leq 5$ (where k is a whole number)



$k = \{5, 4, 3, 2, 1, 0\}$

2. Write the solution sets for the following

$h \geq 9$

$b < -4$

$y \leq -5$

SUB TOPIC: Solving inequalities and writing their solution sets

When dividing by a negative co-efficient
, the sign changes at the step of division.

Examples:

Solve the following and write the solution set

1. $4X > 20$

$$4X > 20$$

$$\frac{4X}{4} > \frac{20}{4}$$

$$X > 5$$

$$X = \{6, 7, 8, 9, 10, \dots\}$$

2. $-4m > 20$

$$-4m > 20$$

$$\frac{-4m}{-4} < \frac{20}{-4}$$

$$m < -5$$

$$m = \{-6, -7, -8, -9, \dots\}$$

3. $3x + 6 < 9$

$$3x + 6 - 6 < 9 - 6$$

$$3x < 3$$

$$\frac{3x}{3} < \frac{3}{3}$$

$$X < 1$$

$$x = \{0, -1, -2, -3, \dots\}$$

4. $\frac{x}{7} - 5 > -4$

$$\frac{x}{7} - 5 > -4$$

$$7 \times \frac{x}{7} - 5 \times 7 > -4 \times 7$$

$$x - 35 > -28$$

$$x - 35 + 35 > -28 + 35$$

$$x > 7$$

$$x = \{8, 9, 10, 11, \dots\}$$

Mathematics is the key

Solve the following and write the solution sets

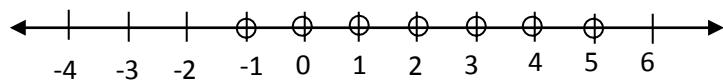
- a) $5m < 20$
- b) $6p > -18$
- c) $2(x + 1) > 4$
- d) $3(2x + 3) < 18$
- e) $3y + 2 < 11$
- f) $4 - k \geq 9$
- g) $\frac{2w}{3} - 12 > 0$

SUB TOPIC: Compound inequalities(writing solution sets)

Examples

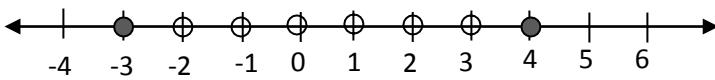
1. Write the solution set for

(a) $-2 < d < 6$



$d = \{-1, 0, 1, 2, 3, 4, 5\}$

(b) $4 \geq m \geq -3$



$m = \{-3, -2, -1, 0, 1, 2, 3, 4\}$

(c) $-6 < w < 2$

(d) $1 < p < 9$

(e) $7 > x - 4$

SUB TOPIC: Solving and writing solution sets with compound inequalities.

Examples

Solve the following and write the solution sets

1. $8 > 2x > 2$

$$\begin{aligned} 8 &> 2x > 2 \\ \frac{8}{2} &> \frac{2x}{2} > \frac{2}{2} \\ 4 &> x > 1 \end{aligned}$$

$x = \{2, 3\}$

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2. $12 < -3x < 24$

$$\begin{aligned}12 &< -3x < 24 \\ \frac{12}{-3} &> \frac{-3x}{-3} > \frac{24}{-3} \\ -4 &> x > -8 \\ x &= \underline{\{ -5, -6, -7 \}}\end{aligned}$$

3. $13 \geq 3x - 2 \geq 4$

$$\begin{aligned}13 &\geq 3x - 2 \geq 4 \\ 13 + 2 &\geq 3x - 2 + 2 \geq 4 + 2 \\ 15 &\geq 3x \geq 6 \\ \frac{15}{3} &\geq \frac{3x}{3} \geq \frac{6}{3} \\ 5 &\geq x \geq 2 \\ x &= \underline{\{ 2, 3, 4, 5 \}}\end{aligned}$$

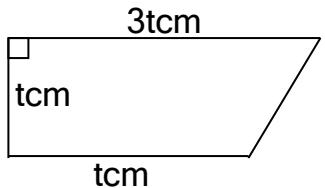
4. $12 > 3m > 3$

5. $15 \leq -5m \leq 40$
6. $-12 \geq 6b > 18$

TOPICAL WORK ON ALGEBRA

1. Solve: $x + 4x = 5$
2. Find the value of $\frac{5a - (m - a)}{a}$ when $a = 3$ and $m = 6$
3. Solve for b in $\frac{3}{5}(2b - 3) = 3$
4. If $\frac{1}{6}x = 1$. Find the value of x.
5. Solve $\frac{2x+2}{3} = \frac{x+3}{2}$
6. What is the value of $\frac{bc-d}{c^2}$ when $b = 8$, $c = 3$ and $d = 6$?
7. Solve: $x - 1 = 2x + 5$
8. Simplify: $(3x + 5) - (x + 1)$
9. Solve: $\frac{1}{2}(3y - 2) = \frac{2}{3}(2y + 3)$
10. Solve: $3(p - 4) - 2(3p - 1) = 2p - 15$
11. Simplify: $(4p - 3q) - (2q + p)$
12. Solve: $\frac{12}{x} + 2 = 6$

13. The area of the trapezium is 50cm^2 . Find the value of t.



14. Given that $a = \frac{1}{2}$, $b = \frac{1}{3}$ and $c = \frac{1}{4}$. Find the value of $b + 2c + 3a$.

15. Subtract $2x - 4$ from $5x - 4$

16. Zahara's mother bought 8 books at shs $(x - 150)$ each and 2 Mathematical sets at shs $(x + 100)$ each. She spent shs 5300 altogether. Find the amount of money spent on books.

17. Tom has three daughters; Amanda, Brenda and Kate. Brenda is 2 years younger than Amanda, Kate's age is $\frac{1}{2}$ that of Brenda. The total age of the three girls is 27 years. How old is Kate?

18. Find the solution set for the following inequalities:

(i) $x > 3$ (ii) $x < -5$ (iii) $x < 2$
(iv) $x > 2$ (v) $x < 4$

- (ii) Solve and give the solutions for x.

(i) $-3x < -9$ (ii) $-30 < 6x$
(iii) $3x + 2 < 11$ (iv) $4x - 5 < 19$

- (iii) Solve and find the solution set for $\frac{y}{3} + 4 < 6$

- (iv) Solve the inequality below:

$$8 > 2x > -4$$

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